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審査請求　未請求　請求項の数6　ＯＬ　（全 12 頁）　最終頁に続く

(54)【発明の名称】　ヒータ制御方法および画像形成装置

(57)【要約】

【課題】 2値制御とは異なる多値制御により、温度調整中によりきめ細かな温度制御を行うとともに電流変動（フリッカ値）を低減する。

【解決手段】ヒータの加熱対象の温度を、3つの閾値Ta, tb, tcで分割された4つの温度範囲に分割する。一方、交流電源電圧の連続する3半波長分を周期とした通電パターンであって、半波の間引きの無い第1の通電パターン、1半波を間引く第2の通電パターン、2半波を間引く第3の通電パターン、および通電無しの第4の通電パターンを用意し、これらをそれぞれ温度の低い側から前記4つの温度範囲に割り当てる。ヒータ温度調整の制御時には、逐次、ヒータの加熱対象の温度を検出し、この検出された温度が前記4つの温度範囲のうちのどの温度範囲に属するかを判定する。その属する温度範囲に対応する通電パターンでヒータを制御する。
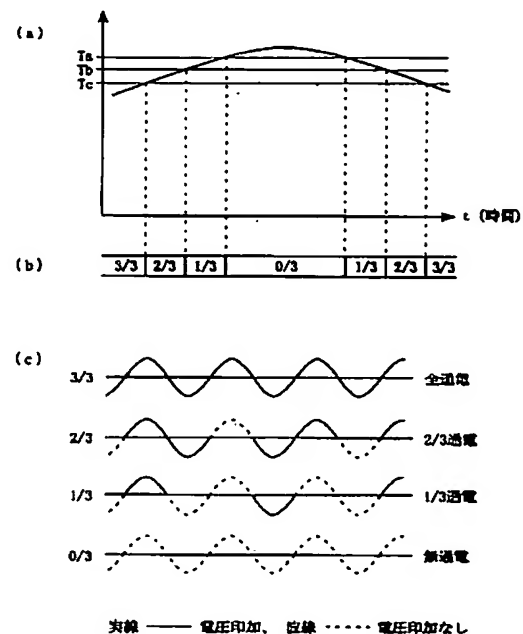
図5

【特許請求の範囲】
【請求項１】交流電源によりヒータを駆動する際のヒータ制御方法であって、

逐次、ヒータの加熱対象の温度を検出するステップと、

この検出された温度が、３つの閾値で分割された４つの温度範囲のうちのどの温度範囲に属するかを判定するステップと、

電源電圧の連続する３半波長分を周期とした通電パターンであって、半波の間引きの無い第１の通電パターン、１半波を間引く第２の通電パターン、２半波を間引く第３の通電パターン、および通電無しの第４の通電パターンを、それぞれ温度の低い側から前記４つの温度範囲に割り当て、前記判定された温度範囲に割り当てられた通電パターンで前記ヒータを制御するステップと、

を備えたことを特徴とするヒータ制御方法。

【請求項２】前記第２、第３および第４の通電パターンの少なくとも１つによる前記ヒータの制御は、前記加熱対象の温度を考慮することなく、少なくとも１周期より長い予め定めた時間継続させることを特徴とする請求項１記載のヒータ制御方法。

【請求項３】請求項１または２に記載のヒータ制御方法であって、第２の通電パターンから第１の通電パターンへ移行させる温度閾値をＴａ、第３の通電パターンから第２の通電パターンへ移行させる温度閾値をＴｂ、第４の通電パターンから第３の通電パターンへ移行させる温度閾値をＴｃとしたとき、これらの温度閾値の関係を、
Ｔａ＞Ｔｂ＞Ｔｃ
とするとともに、

逆に、第１の通電パターンから第２の通電パターンへ移行させる温度閾値をＴａ’、第２の通電パターンから第３の通電パターンへ移行させる温度閾値をＴｂ’、第３の通電パターンから第４の通電パターンへ移行させる温度閾値をＴｃ’としたとき、
Ｔａ≧Ｔａ’
Ｔｂ≧Ｔｂ’
Ｔｃ≧Ｔｃ’
（ただし、この３つの式全てを等号とする条件は除く）
の関係としたことを特徴とするヒータ制御方法。

【請求項４】交流電源によりヒータを駆動する際のヒータ制御方法であって、

逐次、ヒータの加熱対象の温度を検出するステップと、

この検出された温度が、６つの閾値で分割された７つの温度範囲のうちのどの温度範囲に属するかを判定するステップと、

電源電圧の連続する３半波長分を周期とした通電パターンであって、半波の間引きの無い第１の通電パターン、１半波を間引く第２の通電パターン、２半波を間引く第３の通電パターン、および通電無しの第４の通電パターンのうち、第１の通電パターンと第１の通電パターンとを組み合わせた第１の組合せ通電パターン、第２の通電

パターンと第１の通電パターンとを組み合わせた第２の組合せ通電パターン、第２の通電パターンと第２の通電パターンとを組み合わせた第３の組合せ通電パターン、第３の通電パターンと第２の通電パターンとを組み合わせた第４の組合せ通電パターン、第３の通電パターンと第３の通電パターンとを組み合わせた第５の組合せ通電パターン、第４の通電パターンと第３の通電パターンとを組み合わせた第６の組合せ通電パターン、第４の通電パターンと第４の通電パターンとを組み合わせた第７の組合せ通電パターンを、それぞれ温度の低い側から前記７つの温度範囲に割り当て、前記判定された温度範囲に割り当てられた組合せ通電パターンで前記ヒータを制御するステップと、

を備えたことを特徴とするヒータ制御方法。

【請求項５】交流電源によりヒータを駆動する際のヒータ制御方法であって、

逐次、ヒータの加熱対象の温度を検出するステップと、

この検出された温度が、（ｎ−１）個の閾値で分割されたｎ個（ｎは３以上の整数）の温度範囲のうちのどの温度範囲に属するかを判定するステップと、

電源電圧の連続するｍ半波長分（ｍは３以上の奇数）を周期とした１または複数の通電パターンを単位通電パターンとして、半波の間引き数の順次大となる第１から第ｎの単位通電パターンを、それぞれ温度の低い側から前記ｎ個の温度範囲に割り当て、前記判定された温度範囲に割り当てられた通電パターンで前記ヒータを通電するステップと、

を備えたことを特徴とするヒータ制御方法。

【請求項６】トナー像を用紙上に定着させる定着装置を有する画像形成装置であって、

前記定着装置に内蔵される定着ヒータと、

このヒータに対する交流電源電圧の印加を制御するスイッチング手段と、

前記定着ヒータの温度を検出する温度検出手段と、

前記温度検出手段により検出された温度が、（ｎ−１）個の閾値で分割されたｎ個（ｎは３以上の整数）の温度範囲のうちのどの温度範囲に属するかを判定する手段と、

電源電圧の連続するｍ半波長分（ｍは３以上の奇数）を周期とした１または複数の通電パターンを単位通電パターンとして、半波の間引き数の順次大となる第１から第ｎの単位通電パターンを、それぞれ温度の低い側から前記ｎ個の温度範囲に割り当て、前記判定された温度範囲に割り当てられた通電パターンで前記スイッチング手段を制御する制御手段と、

を備えたことを特徴とする画像形成装置。

【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、主として、静電式複写機、プリンタ等の画像形成装置に内蔵される定着装

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置のヒータ制御に関し、特に、温度調整のためのヒータの通電時の急激な電流変動を低減させることができるヒータ制御方法および画像形成装置に関する。

【０００２】

【従来の技術】従来、この種のヒータには、比較的消費電流の大きいハロゲンランプが使用されており、そのＯＮ時には突入電流などの大きな電流変動が発生する。

【０００３】図１は、定着ローラの概略図を示す。定着ローラは、ヒータ４を内蔵するヒータローラ１と、このヒータローラ１に対して加圧される加圧ローラ２とを有する。この両ローラ１，２間に用紙３を通過させることにより、用紙３上に現像されたトナー画像を用紙３上に熱融着させる。

【０００４】図２は、ヒータローラ１の温度調整のための従来のＯＮ／ＯＦＦ制御時のヒータ通電電流波形を示す。この波形において、Ｐ１，Ｐ２部が、ヒータのＯＦＦ状態、ＯＮ状態の切り替わり時点に対応する急激な電流変化部分である。この電流変動が、供給電源そのものの電圧変動を生じさせ、同一電源に接続されている照明等のチラツキを引き起こしてきた。すなわち、図４に示すように、一般的に、電源コンセントの外側から供給電源ＡＣを見た場合、比較的小さな電源インピーダンスＲｓが存在する。このため、電源ＡＣへの接続機器（ここでは、複写機）Ｄの消費電流が大きく急に変化したときは、電源インピーダンスＲｓによる電圧降下に起因して、電源電圧の変動が発生する。急激な電流変化をΔＩとすれば、急激な電源電圧変動分ΔＶは、次式で表される。

【０００５】$\Delta V = Rs \times \Delta I$
例えば、このコンセントラインに照明器具Ｌが接続されていれば、急激な電源電圧変動は照明のチラツキとなって現れてくる。近年、このような機器の急激な電流変化による電源電圧変動を低減させようとする要請が強まっている。

【０００６】

【発明が解決しようとする課題】このような、照明器具のチラツキを防止するには、電流変化を緩やかにする必要がある。すなわち、複写機等の定着装置に使用されるハロゲンヒータによる急激な電流変化を低減する必要がある。（このことを、本明細書では「フリッカ値の低減」ともいう。）具体的には、図２内に示されたハロゲンヒータ通電電流ＯＮ時のＰ１，ＯＦＦ時のＰ２部の急激な電流変化部分を緩和することが必要である。

【０００７】この問題点を解決するための方法は、図３に示すような位相制御（導通角制御）によるヒータへの通電である。既に述べたように、ヒータＯＮ直後の突入電流発生時のような急激な電流変化を防止するには、実効的に印加電圧を徐々に大きくしていけばよく、例えば図３のヒータ通電電流波形に示した形で、まず、交流電源電圧の各半波長内の通電時間を、初めは小さくし、徐

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々に大きくしていく（ｔ１，ｔ２，ｔ３，．．．ｔn）。

【０００８】この方法は周知であり、事実理想に近い穏やかな電流変化をさせることも可能である。しかし、その方法には、以下のような欠点も存在する。１．位相角を決めるためのタイマ機構など、そのハードウェアが複雑であり、それらの設定、起動などの制御上の複雑性も同様に高くなると考えられる。２．電源周波数の異なる地域（５０Ｈｚ，６０Ｈｚの地域差）に対しては、各々別の設定が必要で、切り分け管理に対する煩雑さがある。３．図３を見ても明らかなように、ヒータへの通電がゼロクロス起点ではなく、半波長内でＯＮされているため、高調波電流が増大する。この電流は、電源周波数の高次波（数倍〜数十倍）で発生する。これは給電線を通して接続された他の機器へノイズとして妨害を与え、誤動作や故障の原因となる。従って、位相制御の場合には、この高調波電流を低減するため、別途、大容量のチョークコイルを挿入する等の対応が必要となっている。

【０００９】位相制御によるもの以外では、特開平９−８０９６１号公報に、ヒータのＯＮタイミングとＯＦＦタイミングとの少なくともＯＮタイミングから所定時間は交流連続点灯による定格の通電電力より少ない電力になるような交流不連続パターンによりゼロクロス点灯をするようにヒータに電力を供給する技術が開示されている。また、特開平１１−９５６１１号公報には、２本のヒータを備える定着装置におけるゼロクロス点灯の技術が開示されている。これらにより、ヒータＯＮ時の突入電流を低減し、ノイズの発生を低減することができる。

【００１０】通常、定着装置では、ヒータローラの温度を所定温度に維持するために、継続的な温度調整が行われている。この所定の温度は、コピー時や待機時等の動作モードによって異なりうるが、いずれにせよ、ヒータのＯＮ／ＯＦＦは、ヒータローラの温度を所定値（閾値）と比較することにより行われる。すなわち、温度が所定値より低下したらヒータのＯＮ信号を出力し、所定値を超えたらヒータのＯＦＦ信号を出力するものである。温度上昇時と下降時の閾値を異ならせる（すなわちヒステリシスをもたせる）ことはあるが、いずれにせよ、従来のヒータ制御は原則的には２値制御である。

【００１１】これに対して、本発明は、温度調整中によりきめ細かな温度制御を行うとともに電流変動（フリッカ値）を低減することができる新規なヒータ制御方法および画像形成装置を提供することを目的とする。

【００１２】

【課題を解決するための手段】上記目的を達成するために、本発明によるヒータ制御方法は、交流電源によりヒータを駆動する際のヒータ制御方法であって、逐次、ヒータの加熱対象の温度を検出するステップと、この検出された温度が、３つの閾値で分割された４つの温度範囲のうちのどの温度範囲に属するかを判定するステップ

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と、電源電圧の連続する３半波長分を周期とした通電パターンであって、半波の間引きの無い第１の通電パターン、１半波を間引く第２の通電パターン、２半波を間引く第３の通電パターン、および通電無しの第４の通電パターンを、それぞれ温度の低い側から前記４つの温度範囲に割り当て、前記判定された温度範囲に割り当てられた通電パターンで前記ヒータを制御するステップとを備えたことを特徴とする。

【００１３】このように、ヒータの加熱対象の温度範囲を４つの分割し、各温度範囲に対して４つの異なる通電パターン（４値）を割り当てることにより、従来のＯＮ／ＯＦＦ２値の制御に比べて高精度な温度制御を行うことが可能となるとともに、電流変動の低減によるフリッカ値の低減も達成できる。

【００１４】このヒータ制御方法において、好ましくは、前記第２、第３および第４の通電パターンの少なくとも１つによる前記ヒータの制御は、前記加熱対象の温度を考慮することなく、少なくとも１周期より長い予め定めた時間継続させる。これによって、このような時間継続を行わない場合に比べてフリッカ値をさらに低減することができる。

【００１５】上記ヒータ制御方法において、第２の通電パターンから第１の通電パターンへ移行させる温度閾値をＴａ、第３の通電パターンから第２の通電パターンへ移行させる温度閾値をＴｂ、第４の通電パターンから第３の通電パターンへ移行させる温度閾値をＴｃとしたとき、これらの温度閾値の関係を、

【００１６】Ｔａ＞Ｔｂ＞Ｔｃ
とするとともに、

【００１７】逆に、第１の通電パターンから第２の通電パターンへ移行させる温度閾値をＴａ'、第２の通電パターンから第３の通電パターンへ移行させる温度閾値をＴｂ'、第３の通電パターンから第４の通電パターンへ移行させる温度閾値をＴｃ'としたとき、

【００１８】Ｔａ≧Ｔａ'
Ｔｂ≧Ｔｂ'
Ｔｃ≧Ｔｃ'
（ただし、この３つの式全てを等号とする条件は除く）の関係とすることもできる。これは、すなわち、４つの温度範囲の境界の閾値の少なくとも１つにいわゆるヒステリシスをもたせるものである。これもフリッカ値の低減に効果がある。

【００１９】本発明による別のヒータ制御方法は、交流電源によりヒータを駆動する際のヒータ制御方法であって、逐次、ヒータの加熱対象の温度を検出するステップと、この検出された温度が、６つの閾値で分割された７つの温度範囲のうちのどの温度範囲に属するかを判定するステップと、電源電圧の連続する３半波長分を周期とした通電パターンであって、半波の間引きの無い第１の通電パターン、１半波を間引く第２の通電パターン、２

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半波を間引く第３の通電パターン、および通電無しの第４の通電パターンのうち、第１の通電パターンと第１の通電パターンとを組み合わせた第１の組合せ通電パターン、第２の通電パターンと第１の通電パターンとを組み合わせた第２の組合せ通電パターン、第２の通電パターンと第２の通電パターンとを組み合わせた第３の組合せ通電パターン、第３の通電パターンと第２の通電パターンとを組み合わせた第４の組合せ通電パターン、第３の通電パターンと第３の通電パターンとを組み合わせた第５の組合せ通電パターン、第４の通電パターンと第３の通電パターンとを組み合わせた第６の組合せ通電パターン、第４の通電パターンと第４の通電パターンとを組み合わせた第７の組合せ通電パターンを、それぞれ温度の低い側から前記７つの温度範囲に割り当て、前記判定された温度範囲に割り当てられた組合せ通電パターンで前記ヒータを制御するステップとを備えたことを特徴とする。これも別の多値制御の一例であり、上記のヒータ制御方法と同様の効果が得られる。

【００２０】本発明によるヒータ制御方法は、別の観点によれば、交流電源によりヒータを駆動する際のヒータ制御方法であって、逐次、ヒータの加熱対象の温度を検出するステップと、この検出された温度が、（ｎ−１）個の閾値で分割されたｎ個（ｎは３以上の整数）の温度範囲のうちのどの温度範囲に属するかを判定するステップと、電源電圧の連続するｍ半波長分（ｍは３以上の奇数）を周期とした１または複数の通電パターンを単位通電パターンとして、半波の間引き数の順次大となる第１から第ｎの単位通電パターンを、それぞれ温度の低い側から前記ｎ個の温度範囲に割り当て、前記判定された温度範囲に割り当てられた通電パターンで前記ヒータを通電するステップとを備えたことを特徴とする。

【００２１】本発明のヒータ制御方法を実施するための装置は、トナー像を用紙上に定着させる定着装置を有する画像形成装置であって、前記定着装置に内蔵される定着ヒータと、このヒータに対する交流電源電圧の印加を制御するスイッチング手段と、前記定着ヒータの温度を検出する温度検出手段と、前記温度検出手段により検出された温度が、（ｎ−１）個の閾値で分割されたｎ個（ｎは３以上の整数）の温度範囲のうちのどの温度範囲に属するかを判定する手段と、電源電圧の連続するｍ半波長分（ｍは３以上の奇数）を周期とした１または複数の通電パターンを単位通電パターンとして、半波の間引き数の順次大となる第１から第ｎの単位通電パターンを、それぞれ温度の低い側から前記ｎ個の温度範囲に割り当て、前記判定された温度範囲に割り当てられた通電パターンで前記スイッチング手段を制御する制御手段とを備えたことを特徴とする。

【００２２】
【発明の実施の形態】以下、本発明の好適な実施の形態について、詳細に説明する。

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【００２３】まず最初に、本発明の概念を説明する。本発明の方法は、従来のヒータＯＮ／ＯＦＦ（２値）制御に対して制御精度をより高めることのできるヒータ制御方法を提供するものであり、これにより効果的にフリッカ値を低下させることができる。このヒータ制御方法を「多値比例制御」と呼ぶことにする。

【００２４】１つの好適な実施の形態は、３半波長を１周期としこの１周期から異なる個数の半波を間引いて得られる４値（０，１／３，２／３，３／３）の通電パターンを用いる４値比例制御である。この制御では、図５（ａ）に示したように、４値を切り替える３つの境界温度値（閾値）をＴａ，Ｔｂ，Ｔｃとし、これらの関係をＴａ＞Ｔｂ＞Ｔｃに設定する。（例えばＴｂをはプリントまたはコピー時の目標温度とする。）これらの境界温度値で区画される４つの温度範囲に対して、図５（ｂ）に示すように、それぞれ異なる間引き数の半波を間引いた１周期の印加電圧パターン（通電パターン）を割り当てる。仮に、温度が図５（ａ）に示すような変化をしたとすると、４値通電パターン（通電状態）は、順次、３／３→２／３→１／３→０／３→１／３→２／３→３／３というように変化することになる。図５（ｃ）は、これらの４値の各々の通電パターンを示している。

【００２５】なお、図５（ａ）は実際のヒータローラ１（図１）の温度変化を示すものではなく、４つの通電パターンとの対応関係を示すものである。とはいえ、ヒータローラ１の温度は比較的緩やかに変化するから、ヒータ４への電圧印加の変化は、段階的に（差分１／３ずつ）生じると考えてよい。従って、この方法により急激な電流変化の緩和がなされていると言える。

【００２６】前記の基本的な４値比例制御を発展させ、より多値に分割した通電パターンを適用することも可能である。例えば、３半波長周期の２周期分をセットにした組合せ通電パターンを単位通電パターンとして用いる方法を、本発明の第２の実施の形態として図６に示す。この場合、６半波が単位通電パターンの１周期となる。

【００２７】具体的には、次の７値の状態を示している。

（１）無通電（０／６）と（０／６）を組合わせた（０／６）組合せ通電パターン、（２）通電（１／３）と（０／３）を組合わせた（１／６）組合せ通電パターン、（３）通電（１／３）と（１／３）を組合わせた（２／６）組合せ通電パターン、（４）通電（２／３）と（１／３）を組合わせた（３／６）組合せ通電パターン、（５）通電（２／３）と（２／３）を組合わせた（４／６）組合せ通電パターン、（６）通電（３／３）と（２／３）を組合わせた（５／６）組合せ通電パターン、（７）通電（３／３）と（３／３）を組み合わせた、即ち全通電の（６／６）組合せ通電パターン。

【００２８】このように３半波長周期の２周期分（６半波長分）を単位通電パターンとすれば、７値の比例制御

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が可能となる。同様に、３半波長周期の３周期分（９半波長分）をセットパターンとすれば、１０値の段階が得られる。更に周期を増すことで、より多値を得られることとなる。このような複数周期分（３半波長分の倍数分）を単位通電パターンとした形においても、各電流変化は、単なる全通電ＯＮ／ＯＦＦと比較すれば１／３となるため、ヒータ通電による急激な電流変化を減らす方向に働く。

【００２９】更に考えを進めて、人間にとってチラツキを感じやすい周波数（８Ｈｚ付近）での電流変化を避ける方法を、本実施の形態の第１の変形例として、説明する。図５で説明した通電変化３／３→２／３→１／３→０→１／３→２／３→３／３の各状態への切り換え頻度を８Ｈｚ付近からもっと低域方向へ移すようにすればよい。すなわち、各通電パターンへの切り換え温度ＴａとＴｂ，ＴｂとＴｃの差を所定値以上として各通電パターン（１／３），（２／３），（３／３）の各状態に滞留する時間（３半波長周期の数）を強制的に所定値以上となるように管理すれば、電流変化頻度を低下させ変化周波数をより低域へと移動させることができる。例えば、２３０Ｖ、８００Ｗのハロゲンヒータについて、Ｔａ＝１８６゜Ｃ，Ｔｂ＝１８５゜Ｃ，Ｔｃ＝１８４゜Ｃとし、最小限の強制滞留時間（最低継続時間）を３半波長周期の１周期（３半波）から１周期毎に８周期（２４半波）まで変化させた本発明者による実験では、フリッカメータにより測定されたフリッカ値（Ｐｓｔ）は、１．０１から０．６７まで順次低下した。ここに、Ｐｓｔ（Period Short Time）とは、ＥＮ６１０００-３-３の規格により定められた短時間（１０分間）のフリッカ評価値であり、例えば、ＥＭＣ　１９９５．１０．５（No.90）の第３５頁〜第４１頁の「電圧変動とフリッカ測定」に記載されている。

【００３０】但し、最低継続時間が長くなるほど、温度制御の応答性が悪くなり、ヒータローラの温度の変動が大きくなる。したがって、最低継続時間は２周期（６半波長）以上とすることが望ましいが、応答性も考慮すれば、４周期前後が好ましい。すなわち、最低継続時間が１周期である場合に比べて多少温度制御変動は大きくなっても、定着性を損なわない範囲に制限すれば一層フリッカ値を低減することができる。

【００３１】なお、実際の通電状態の切り換え頻度は、上記最低継続時間で決まるものではなく、ヒータの熱履歴などの影響のため、最低継続時間で換算した周波数より低い周波数となる。

【００３２】本実施の形態の第２の変形例として、Ｔａ，Ｔｂ，Ｔｃについて温度ヒステリシスを持たせるやり方を考える。例えば、通電（１／３）から通電（０／３）に移行するときの温度閾値をＴａ、同（２／３→１／３）の温度閾値をＴｂ、（３／３→２／３）の温度閾値をＴｃ、とし、これに対し逆方向の（０／３→１／

３）の温度閾値をＴａ’、（１／３→２／３）の温度閾
値をＴｂ’、（２／３→３／３）の温度閾値をＴｃ’、
と定める。このとき、

【００３３】Ｔａ≧Ｔａ’、Ｔｂ≧Ｔｂ’、Ｔｃ≧Ｔ
ｃ’
の関係とする（ただし、この３つの式全てを等号とする
条件は除く）。

【００３４】このようにして、各通電パターンの継続時
間を持続し易いようにすることにより、変動頻度周波数
を低域方向に移動させることができる。この第２の変形
例は、第１の変形例と独立に採用することができるが、
両変形例を併用することも可能である。また、両変形例
は、共にまたは単独で、上記第２の実施の形態において
も採用可能である。

【００３５】以上の例では、すべて３半波長周期を基準
とした。ここで、３半波長周期を基準に波数間引きを適
用することの利点について簡単に説明する。例えば通電
パターンの１周期を２半波長（サイン波形の１周期のこ
と）としてみれば、これから１半波長分間引くと半波整
流波形と同じ直流成分となってしまうので、ハロゲンヒ
ータの制御上問題が大きい。また、３半波長周期より長
い周期での間引きは、照明等のチラツキの特性上、その
間引き操作自体、人の目にチラツキとして感じ易くなっ
てくる。従って、２半波長周期以外の一番短い周期、即
ち３半波長周期で考えるのが妥当と言うことになる。事
実、この３半波長周期の間引きにおいて、実際に照明を
接続しチラツキを観測した所、チラツキ感は殆ど感じら
れなかった。

【００３６】但し、５、７等の奇数の半波を基準周期と
することも可能である。このような場合、３半波長周期
に比べればチラツキの点で効果は低下するとしても、電
流変動の低減の効果はなお認められる。ｍ半波長周期
（ｍは３以上の奇数）の場合の温度閾値の個数は同数ｍ
となる。

【００３７】図７は、上述した本実施の形態の「波数制
御」を実現するための制御回路の回路図である。

【００３８】この図中のＴＨは、ヒータローラ（図１内
１）の温度を検知するサーミスタ温度センサ（図１内
５）である。このセンサＴＨは抵抗Ｒ１に接続され、そ
の分圧電位は、中央処理装置ＣＰＵ内のアナログ入力端
子Ａ／Ｄに入力されている。Ａ／Ｄ端子に与えられた信
号は、アナログ／デジタル変換され、ＣＰＵ内で処理さ
れる。ＣＰＵの割込み入力端子ＩＮＴには、電源電圧の
ゼロクロス点で発生したゼロクロスパルスが入力されて
いる。このゼロクロスパルスの発生回路は、図７の上部
のフォトカプラＰＣおよび比較器ＣＯＭ、抵抗Ｒ５〜Ｒ
１０、ダイオードＤにより構成されている。

【００３９】ゼロクロスパルスの立下りに応じてＣＰＵ
内部の割り込みルーチン（後述）が起動され、このゼロ
クロス信号立下り直後にヒータＨＴ（図１内４）を点灯

または消灯させる信号ＯＵＴが出力される。例えば、Ｏ
ＵＴ出力がＨレベルのときには、トランジスタＴＲがＯ
ＦＦとなり、ホトトライアックＰＴの発光側は消灯して
いる。このとき、ホトトライアックＰＴの受光側もＯＦ
Ｆであるので、トライアックＴのゲート電流は流れな
い。よって、トライアックＴはＯＦＦ状態となり、ヒー
タは消灯となる。反対に、ＯＵＴがＬＯＷレベルのとき
は、上述の逆の動作をし、ＴＲはＯＮ、ＰＴの発光ダイ
オードは点灯し、ホトトライアックＰＴ受光側はＯＮす
る。トライアックＴのゲートへは、ホトトライアックＰ
Ｔ受光側が導通するから、抵抗Ｒ２またはＲ３によって
限流されたゲート電流が供給される。従って、トライア
ックＴは導通となって、ヒータは点灯する。Ｔに並列に
接続されたＲ４とＣ１は、スナバ回路であり、外来ノイ
ズなどの影響によって電源電圧の急激な変化があったと
き、トライアックＴが自立的にＯＮするのを防止するた
めのものである。

【００４０】この図７の回路による本実施の形態におけ
るヒータ制御の過程を、再度図５により説明する。まず
図示したように制御温度をＴａ＞Ｔｂ＞Ｔｃの関係を持
たせた３つの閾値を設定する。図７内Ａ／Ｄ端子に入力
される温度検知信号がＴｃ以下の場合には、ヒータに対
し全通電パターン（３／３）を与え、温度がＴｂ≧Ｔ＞
Ｔｃの範囲になった時点で、ヒータに対し通電パターン
（２／３）を与える。更に、温度が上昇しＴａ≧Ｔ＞Ｔ
ｂのレベルとなった場合は、ヒータ通電電力をもっと低
下させ通電パターン（１／３）を印加する。温度がＴ≧
Ｔａとなる場合は、無通電パターン（０／３）を与え
る。温度が低下して来た場合は、前記の逆の過程をたど
り、温度によって通電（１／３）→通電（２／３）→通
電（３／３）とヒータの電力を増大させるようにする
（図５内（ｂ）の過程を示す。）

【００４１】図８にスタンバイ中とプリント（コピー）
中における、実際の温調（温度調整）状態を示してあ
る。スタンバイ中の平均電力がヒータ全電力の１／３以
下であるとすれば、通電（０／３）と通電（１／３）の
間を往復する形で温度が平衡する。また、プリント中の
平均電力がヒータ全電力の（１／３）と（２／３）の間
にあるとすれば、通電（１／３）と通電（２／３）間を
行き来する形で、温度が平衡することとなる。図示した
ように通電状態の切り換え頻度が高い場合には、フリッ
カ値に対しては不利に働く。従ってこの頻度を低下させ
る例として、ある通電状態に突入したとき、前述したよ
うに、その状態に留まる最低継続時間を定めことによ
り、この頻度を低下させることが可能である。

【００４２】図８から分かるように、スタンバイ状態に
入る最初の装置電源ＯＮ時には、通電（３／３）となっ
ており、突入電流が発生しうる。しかし、一旦温度が最
大閾値Ｔａに達した後は、通電（０／３）からは必ず通
電（１／３）、（２／３）を経由して通電（３／３）に

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達する。すなわち、本発明は装置電源ＯＮ時以外の温調時のヒータ制御に向けられているといえる。装置電源ＯＮ時の突入電流に対処するには、装置電源ＯＮ直後のみ上記のような従来の手法を採用してもよい。

【００４３】図９および図１０に跨るフローチャートにより、前記制御を実現するためのソフトウェア手順を説明する。ここでは、３半波長周期を基準とし、最低継続時間を所定値にセットした場合を例とする。

【００４４】ＣＰＵ（図７）に対する割り込み入力端子ＩＮＴに対しては、前記ゼロクロスパルス発生回路からゼロクロスパルスが与えられているから、このパルスの発生（パルス立下り）毎に、ＣＰＵ内処理に割り込み（ＩＮＴ）が掛かり図９から始まるフロー手順が実行される。

【００４５】まず、判断ステップＳ１によって、ヒータローラ温度をサンプルすべきタイミングを指示する温度サンプルフラグ（以下、および図９、図１０においてフラグをＦで表す）を調べる。このフラグのセット、リセットは後述するステップで行われる。このフラグがセットされていれば、Ｓ１のＹ側へフローが移行して、温度Ｔがサンプルされる（Ｓ１９）。ついで、判断ステップＳ２、Ｓ３、Ｓ４により温度Ｔの属する範囲が判定され、対応する細部フローへと移動する。

【００４６】具体的には、判断ステップＳ２でＴ＞ＴａであればそのＹ側へ移行して、通電状態フラグ群０／３Ｆ、１／３Ｆ、２／３Ｆ、３／３Ｆのうち、通電状態フラグ０／３Ｆのみセットされる。そして合流点（ｄ）へ移行する。

【００４７】判断ステップＳ３でＴａ≧Ｔ＞Ｔｂであれば、そのＹ側へ移行し、既に通電状態フラグ１／３Ｆがセットされているか否かをチェックする（Ｓ６）。セットされていなければ、継続カウンタをスタートさせる（Ｓ２３）。この継続カウンタは、前述した最低継続時間を計測するためのものである。ついで、通電状態フラグ１／３Ｆをセットし他の通電状態フラグ（１／３Ｆ、２／３Ｆ、３／３Ｆ）をすべてリセットする（Ｓ２４）。判断ステップＳ６で既に通電状態フラグ１／３Ｆがセットされている場合にも念のために同ステップＳ２４を実行する。

【００４８】判断ステップＳ４でＴｂ≧Ｔ＞Ｔｃであれば、そのＹ側へ移行し、既に通電状態フラグ２／３Ｆがセットされているか否かをチェックする（Ｓ７）。セットされていなければ、継続カウンタをスタートさせる（Ｓ２５）。ついで、通電状態フラグ２／３Ｆをセットし他の通電状態フラグ（０／３Ｆ、１／３Ｆ、３／３Ｆ）をすべてリセットする（Ｓ２６）。判断ステップＳ７で既に通電状態フラグ２／３Ｆがセットされている場合にも念のために同ステップＳ２６を実行する。

【００４９】判断ステップＳ４でＴｂ≧Ｔ＞Ｔｃでなければ、すなわちＴｃ≧Ｔであれば、そのＹ側へ移行し、

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既に通電状態フラグ３／３Ｆがセットされているか否かをチェックする（Ｓ８）。セットされていなければ、継続カウンタをスタートさせる（Ｓ２７）。ついで、通電状態フラグ３／３Ｆをセットし他の通電状態フラグ（０／３Ｆ、１／３Ｆ、２／３Ｆ）をすべてリセットする（Ｓ２８）。判断ステップＳ８で既に通電状態フラグ３／３Ｆがセットされている場合にも念のために同ステップＳ２８を実行する。

【００５０】前述した判断ステップＳ１で温度サンプルＦがセットされていない場合または前記Ｓ２２、Ｓ２４、Ｓ２６、Ｓ２８に続き、間引きカウンタをインクリメントする（Ｓ２０）。間引きカウンタは、割り込み毎にインクリメントされ、その値が３になると（Ｓ９）、０にリセットされる（Ｓ２１）。したがって、間引きカウンタの値は、０→１→２→０→．．．の形で巡回する。この間引きカウンタは、後続の処理でその値を監視することにより波数間引きタイミングを管理するためのものである。すなわち、図１０の判断ステップＳ１０、Ｓ１１、Ｓ１２、Ｓ１３へと移行し、その割り込みが３半波内のどの半波に対応し、かつ、その時点の各通電状態フラグの設定状態に応じて、当該半波をＯＮするかＯＦＦするかを判断し、制御信号の出力を指示する。

【００５１】具体的には、判断ステップＳ１０では、通電状態フラグ０／３Ｆのセットの有無を見て、Ｙｅｓであれば間引きカウンタの値に関わらず出力信号ＯＵＴをＯＮしヒータを消灯する（Ｓ３１）。

【００５２】判断ステップＳ１１では、通電状態フラグ１／３Ｆのセットの有無を調べ、Ｙｅｓであれば間引きカウンタが０のときのみ（Ｓ１４、Ｙｅｓ）ヒータをＯＮし（Ｓ３３）、それ以外のときにはＯＦＦする（Ｓ３２）。よって、３半波内の１半波のみＯＮ、２半波間引きとなる。

【００５３】判断ステップＳ１２では、通電状態フラグ２／３Ｆのセットの有無を調べ、Ｙｅｓであれば間引きカウンタが２のときのみ（Ｓ１５、Ｙｅｓ）ヒータをＯＦＦし（Ｓ３５）、それ以外のときにはヒータはＯＮする（Ｓ３４）。すなわち、３半波のうち、１半波（間引きカウンタが２のとき）間引くこととなる。

【００５４】判断ステップＳ１３では、通電状態フラグ３／３Ｆのセットの有無を調べ、Ｙｅｓであれば、間引きカウンタの値に関わらずヒータをＯＮとする（Ｓ３６）。すなわち、ヒータは全通電となる。判断ステップＳ１３で判断結果がＮｏであれば、温度サンプルＦをセットし（Ｓ３７）、本割り込み処理を終了する（リターンする）。ステップＳ３７は、初期時点等または何らかの理由でいずれの通電状態フラグもセットされていない場合に対処するためのものである。

【００５５】Ｓ３１～Ｓ３６の各ヒータのＯＮ／ＯＦＦ設定に続く判断ステップＳ１６では、間引きカウンタ値を調べ、３半波長周期の区切り（最後の半波）かどう

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か、すなわち間引きカウンタ値が２か否かを調べる。このような区切りの位置でなければ、温度サンプルFをリセットし（S３９）、リターンする。

【００５６】判断ステップS１６で間引きカウンタが２のとき、即ち３半波長周期の区切り（最後の半波）に来たときに、次の判断ステップS１７で継続カウンタがカウント中か否かを調べる。継続カウンタがカウント中とは、先のステップS２３，S２５，S２７のいずれかで継続カウンタがスタートされたことを意味する。カウント中であれば継続カウンタをインクリメントする（S３８）。この継続カウンタは、前述したように、強制的に通電状態を一定時間（３半波長周期の倍数）以上持続するために設定されている。この継続カウンタが所定値に達していなければ（S１８，No）、合流点（g）に移行する。ここで、温度サンプルFがリセットされる（S３９）。よって、次の割り込みサイクルでは、温度サンプルはなされず間引きカウンタ値に基づいた波数間引き通電が引き続き持続されることとなる。このようにして、通電状態の最低継続時間を継続カウンタで管理している。

【００５７】S１８で継続カウンタが所定値に達している場合には、継続カウンタを停止させる（S４０）。また、温度サンプルFをセットすることによって（S４１）、次の割り込みルーチンの始めに温度サンプルを行って、通電状態を温度サンプルに応じて切り換えることを指示する。

【００５８】ステップS４１で温度サンプルFがセットされた後の次の割り込みルーチンの初め（図９）には、温度Tがサンプルされ（S１９）、ステップS１にてY側へ移行してその温度Tを調べることになる。例えば、温度がTa≧T＞Tb内にあれば、判断ステップS３のY側に流れて、ステップS６で、以前セットしていた通電状態フラグが、これからセットする通電状態フラグ１／３Fと同じかどうか判断する。同じ場合には、継続カウンタをスタートさせず停止させたままにして同１／３Fのみをセットし（S２４）、次の合流点（d）へと移行させる。以後、３半波長周期の間、２半波間引きがなされ、３半波長周期の区切りで（S１６でY側）、継続カウンタは既に停止しているので、S１７でN側に処理移行し、再び温度サンプルFがセットされる（S４１）。

【００５９】同様に次の割り込みルーチン開始時に判断ステップS１でY側に流れて、例えば温度がTb≧T＞Tcで判断ステップS４を通過したとすれば、直前の通電状態Fは１／３Fであったから、判断ステップS７で通電状態の切り換えがあると見なしN側へ処理移行し、継続カウンタをスタートさせ（S２５）、かつ２／３Fをセットする（S２６）。この２／３通電は、少なくとも、継続カウンタに指示された時間継続することになる。

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【００６０】判断ステップS２においては、Y側で直前のフラグの調査をせず、継続カウンタのスタート指示はなく、ここでセットされる通電F（０／３F）の最低継続時間を指定していない。すなわち本実施の形態では、０／３通電状態に対しては、３半波長周期を超える継続を故意に指示していない。定着ヒータの完全消灯は、用紙への定着性という観点から継続するのは望ましくないため、強制的な継続性を、あえて無い状態としている。

【００６１】以上述べた、３半波長基準の本実施の形態のメリットとしては次のような事項が挙げられる。

【００６２】（１）電源電圧の連続する３半波長分を周期として、半波の間引きの無い（３／３）通電と、３半波長を周期として１半波を間引く（２／３）通電と、２半波を間引く（１／３）通電と、通電無し（０／３）の４段階の通電パターンを、ヒータの加熱対象温度の４分割範囲にそれぞれ対応づける４値制御により、従来の２値制御に比べてよりきめ細かな高精度の温度制御を達成できる。

【００６３】同時に、継続的な温度調整において、通電状態の変化（差分）は常に１／３（図８参照）すなわち１周期当たり半波分なので、ヒータ通電の急激な電流変化を効果的に低減することができる。

【００６４】（２）また、制御ハードウェアが比較的単純である。例えば、前述したような位相制御方式の場合、電源電圧のゼロクロス点からタイマを設定してヒータをONすべき位相角を指定するパルスを発生させる必要がある。これらは、制御自体の複雑性とタイマ機構等のハードウェアを用意しなければならない。これに対して、「波数制御」であれば、ゼロクロス起点でヒータをONするのみであるため、位相を決定するタイマが不要となる。また、その分それらの設定、起動等、制御上の複雑性は減少する。

【００６５】（３）さらに、「波数制御」の場合のヒータ電流は、ゼロクロス起点から印加されるため、電源ライン上における電源周波数の高次の周波数電流変化、いわゆる電源高調波の発生が殆どない。通常、このような電源高調波の発生を抑えるために、ヒータと直列に大容量のインダクタンス（チョークコイル）を挿入したりして、余計な電気部品の追加によるコスト上昇とその設置場所の確保による機械のコンパクト化に対する障害になっていたが、本実施の形態によりこのような問題が解消される。

【００６６】以上、本発明の好適な実施の形態について説明したが、種々の変形、変更が可能である。

【００６７】

【発明の効果】本発明によれば、２値制御とは異なる多値制御を行うことにより、温度調整中によりきめ細かな温度制御を行うとともに電流変動（フリッカ値）を低減することができる。

【図面の簡単な説明】

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【図１】本発明が適用される対象の一例としての定着ローラの概略図である。

【図２】図１のヒータローラの温度調整のための従来のＯＮ／ＯＦＦ温度制御時のヒータ通電電流波形を示す図である。

【図３】従来の位相制御（導通角制御）によるヒータへの通電の説明図である。

【図４】機器電流変動に起因する電源電圧の変動の発生の説明図である。

【図５】本発明の実施の形態における４つの温度範囲（ａ）と異なる間引き数の通電状態（ｂ）と、異なる通電状態の波形（ｃ）を示す図である。

【図６】本発明の他の実施の形態における、３半波長周期を２周期分セットにし６半波を新たな１周期とした通電パターンの説明図である。

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* 【図７】本発明の実施の形態の波数制御を実現するための制御回路の回路図である。

【図８】本発明の実施の形態でのスタンバイ中とプリント（コピー）中における、実際の温調（温度調整）状態の一例を示す波形図である。

【図９】本発明の実施の形態における波数制御を実現するためのソフトウェア手順を示すフローチャートである。

【図１０】図９に続くフローチャートである。

【符号の説明】
1    ヒータローラ
2    加圧ローラ
3    用紙
4    ヒータ
5    サーミスタ温度センサ
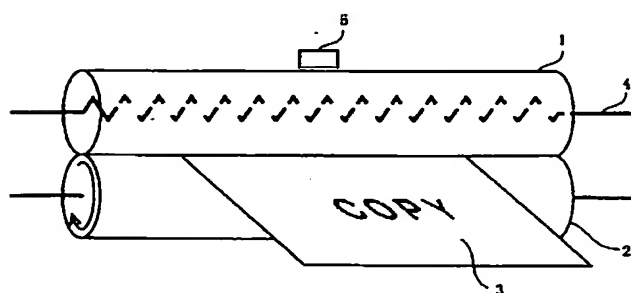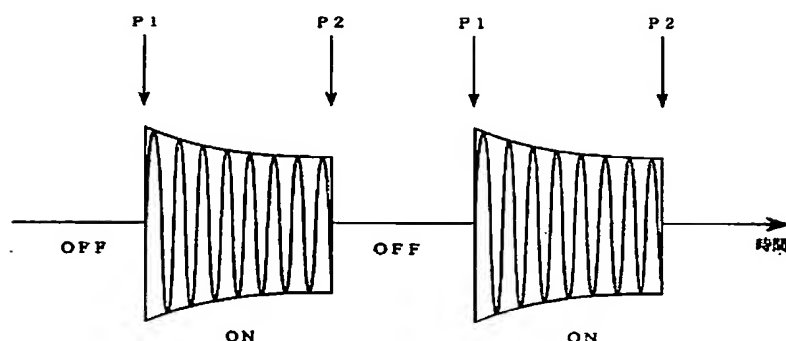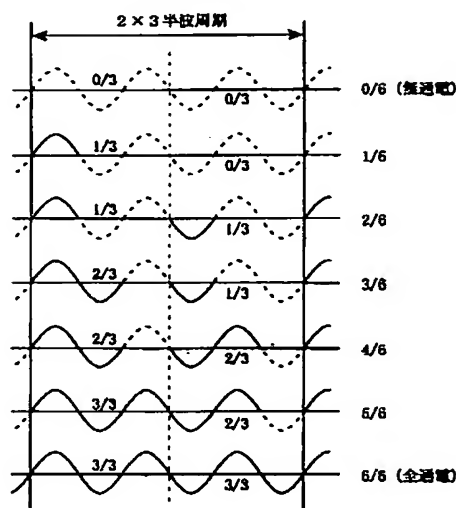
【図１】

図1

【図６】

図6

【図２】

図2    電流波形

【図３】
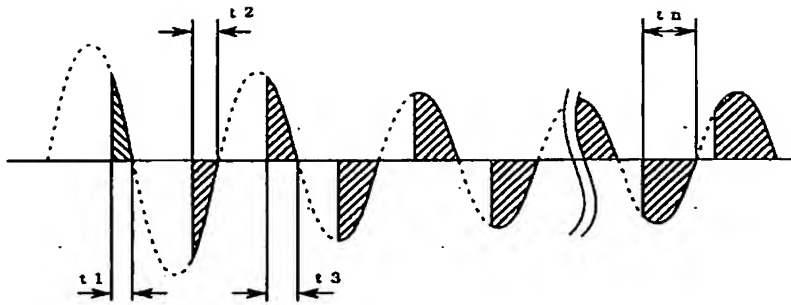


図３　ヒータ電流（位相制御）

【図４】



図４

【図７】



図７

【図８】



図８

【図５】



図５

【図９】
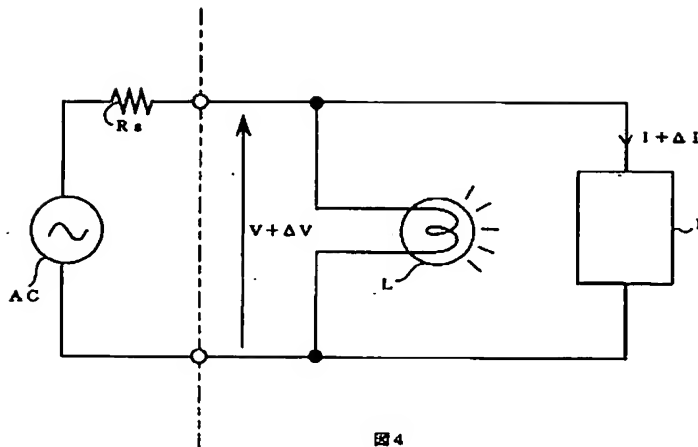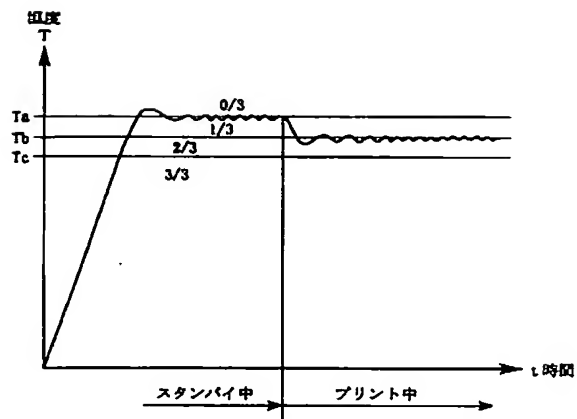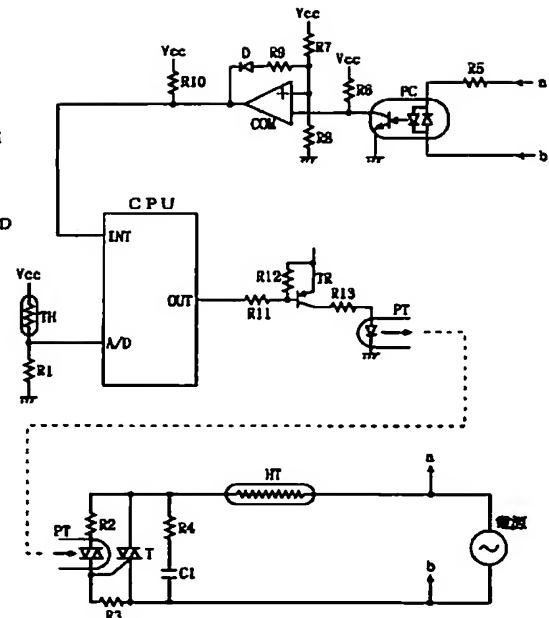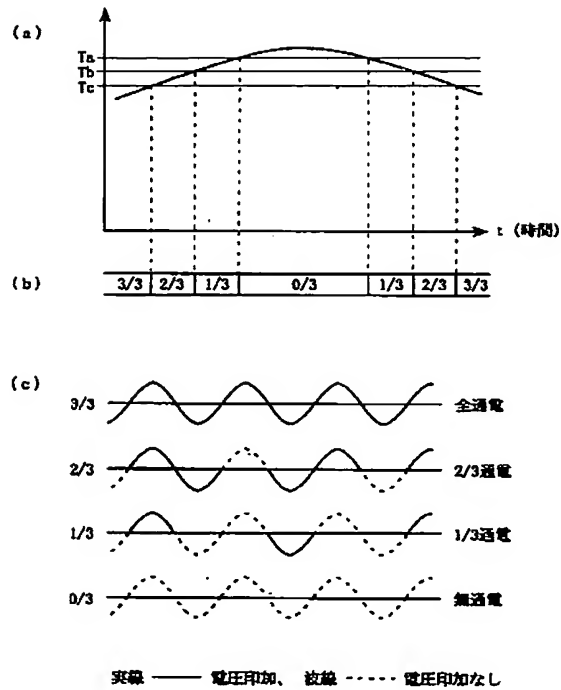


図９
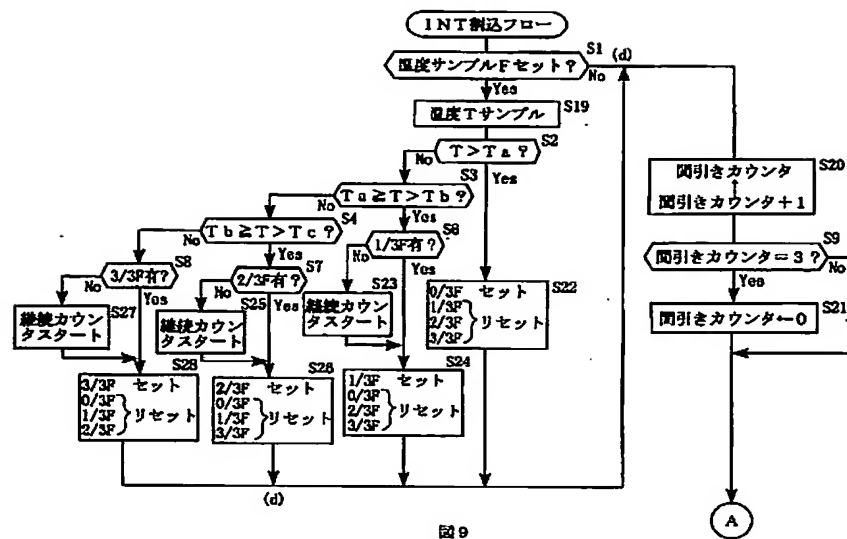
【図１０】
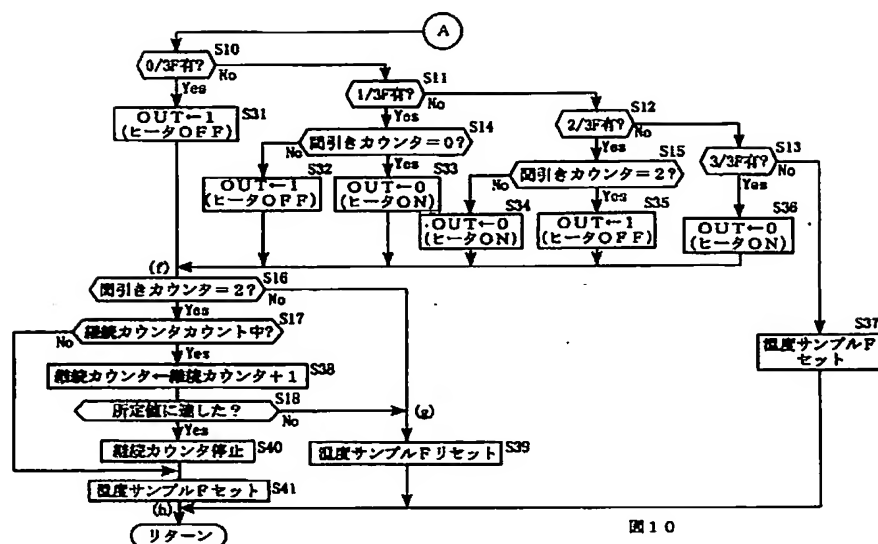


図１０

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# PATENT ABSTRACTS OF JAPAN

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(21)Application number : 2000-237162   (71)Applicant : CANON INC

(22)Date of filing :     04.08.2000    (72)Inventor : NISHIDA YOSHIAKI

## (54) HEATER CONTROL METHOD AND PICTURE FORMING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To perform a careful temperature control in the midst of temperature control by multi-valued control which is different from binary-valued control, and to reduce a variation of current (a flicker value).

SOLUTION: The temperature of an object to be heated by a heater is divided into four temperature ranges divided by three threshold values Ta, Tb and Tc. On the other hand, one period of an alternating current of power source is made to include three half-waves, and four wave forms such as the first wave form of full-wave, the second wave form with deletion of one half-wave, the third wave form with deletion of two half-waves, and a no con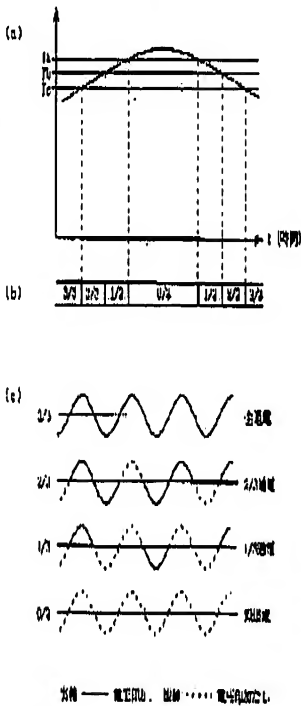duction are prepared, and they are allocated to the four temperature ranges from low temperature side in above sequence respectively. When the temperature of the heater is controlled, the temperature of the object to be heated is detected one after the other, and judged whether to which temperature range out of above four temperature ranges the detected temperature belongs, and the heater is controlled by the wave form corresponding to the temperature range to which, the temperature of the object to be heated belongs.

LEGAL STATUS

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[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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## CLAIMS

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[Claim(s)]
[Claim 1] The step which is the heater control approach at the time of
driving a heater by AC power supply, and detects the temperature for [ of a
heater ] heating serially, The step which judges to which temperature
requirement of the four temperature requirements divided with three
thresholds this detected temperature belongs, It is the energization pattern
which made the period a part for the 3 half-wave lengths which supply
voltage follows. The 1st energization pattern which does not have infanticide
of a half wave, the 2nd energization pattern which thins out one half wave,
The 3rd energization pattern which thins out two half waves, and the 4th
energization pattern without energization The heater control approach
characterized by having the step which controls said heater by the
energization pattern which assigned said four temperature requirements from
the side with respectively low temperature, and was assigned to said judged
temperature requirement.
[Claim 2] Control of said heater by at least one of the said 2nd, 3rd, and 4th
energization patterns is the heater control approach according to claim 1
characterized by the thing longer than at least 1 period which set
beforehand, and to do for time amount continuation, without taking the
temperature for [ said ] heating into consideration.
[Claim 3] The temperature threshold which is the heater control approach
according to claim 1 or 2, and is made to shift to the 1st energization pattern
from the 2nd energization pattern Ta, When the temperature threshold which
makes the temperature threshold made to shift to the 2nd energization
pattern from the 3rd energization pattern shift to the 3rd energization
pattern from Tb and the 4th energization pattern is set to Tc, While making
relation of these temperature thresholds into Ta>Tb>Tc, conversely The
temperature threshold made to shift to the 2nd energization pattern from the
1st energization pattern Ta', When the temperature threshold made to shift

to the 3rd energization pattern from the 2nd energization pattern is made
into Tb' and the temperature threshold made to shift to the 4th energization
pattern from the 3rd energization pattern is made into Tc', The heater
control approach characterized by considering as the relation of
Ta>=Ta'Tb>=Tb'Tc>=Tc' (however, the conditions which make all these three
formulas an equal sign are removed).
[Claim 4] The step which is the heater control approach at the time of
driving a heater by AC power supply, and detects the temperature for [ of a
heater ] heating serially, The step which judges to which temperature
requirement of the seven temperature requirements divided with six
thresholds this detected temperature belongs, It is the energization pattern
which made the period a part for the 3 half-wave lengths which supply
voltage follows. The 1st energization pattern which does not have infanticide
of a half wave, the 2nd energization pattern which thins out one half wave,
The inside of the 3rd energization pattern which thins out two half waves,
and the 4th energization pattern without energization, The 1st combination
energization pattern which combined the 1st energization pattern and the 1st
energization pattern, The 2nd combination energization pattern which
combined the 2nd energization pattern and the 1st energization pattern, The
3rd combination energization pattern which combined the 2nd energization
pattern and the 2nd energization pattern, The 4th combination energization
pattern which combined the 3rd energization pattern and the 2nd
energization pattern, The 5th combination energization pattern which
combined the 3rd energization pattern and the 3rd energization pattern, The
6th combination energization pattern which combined the 4th energization
pattern and the 3rd energization pattern, The 7th combination energization
pattern which combined the 4th energization pattern and the 4th
energization pattern The heater control approach characterized by having
the step which controls said heater by the combination energization pattern
which assigned said seven temperature requirements from the side with
respectively low temperature, and was assigned to said judged temperature
requirement.
[Claim 5] The step which is the heater control approach at the time of
driving a heater by AC power supply, and detects the temperature for [ of a
heater ] heating serially, The step which judges to which temperature
requirement of the n temperature requirements (n is three or more integers)
divided with the threshold of an individual (n-1) this detected temperature
belongs, 1 or two or more energization patterns which made the period a part
for m half-wave length which supply voltage follows (m is three or more odd
number) are used as a unit energization pattern. The heater control approach
characterized by having the step which energizes said heater by the
energization pattern which assigned the n-th unit energization pattern to a

side with respectively low temperature to said n temperature requirements from the 1st used as the sequential size of the number of infanticide of a half wave, and was assigned to said judged temperature requirement.

[Claim 6] The fixing heater which is image formation equipment which has the anchorage device which fixes a toner image on a form, and is built in said anchorage device, A switching means to control the impression of an AC-power-supply electrical potential difference to this heater, A means to judge to which temperature requirement of the n temperature requirements (n is three or more integers) divided with the threshold of an individual (n-1) the temperature detected by temperature detection means to detect the temperature of said fixing heater, and said temperature detection means belongs, 1 or two or more energization patterns which made the period a part for m half-wave length which supply voltage follows (m is three or more odd number) are used as a unit energization pattern. The n-th unit energization pattern from the 1st used as the sequential size of the number of infanticide of a half wave Image formation equipment characterized by having the control means which controls said switching means by the energization pattern which assigned said n temperature requirements from the side with respectively low temperature, and was assigned to said judged temperature requirement.

[Translation done.]

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## DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the heater control approach and image formation equipment which can reduce the rapid current variation at the time of energization of the heater for a temperature control especially mainly about heater control of the anchorage device built in image formation equipments, such as an electrostatic copying machine and a printer.
[0002]
[Description of the Prior Art] Conventionally, the halogen lamp with the comparatively large consumed electric current is used for this kind of heater, and big current variation, such as the rush current, occurs at the time of that ON.
[0003] Drawing 1 shows the schematic diagram of a fixing roller. A fixing roller has the heater roller 1 having a heater 4, and the application-of-pressure roller 2 pressurized to this heater roller 1. Thermal melting arrival of the toner image developed on the form 3 is carried out on a form 3 by passing a form 3 between both this roller 1 and 2.
[0004] Drawing 2 shows the heater energization current wave form at the time of the conventional ON/OFF control for the temperature control of the heater roller 1. In this wave, the OFF condition of a heater and ON condition change and P1 and the P2 section are the rapid current change parts corresponding to an event. This current variation produced the voltage variation of the supply power source itself, and has caused CHIRATSUKI, such as lighting connected to the same power source. That is, generally, as shown in drawing 4 , when the supply power source AC is seen from the outside of a power receptacle, the comparatively small source impedance Rs exists. For this reason, when the consumed electric current of the connection device (here copying machine) D to a power source AC changes suddenly a lot, it originates in the voltage drop by source impedance Rs, and

fluctuation of supply voltage occurs. deltaI, then rapid line-voltage-variation part deltaV are expressed with a degree type in a rapid current change.

[0005] deltaV=Rs x If Luminaire L is connected to deltaI, for example, this plug socket line, rapid line voltage variation will serve as CHIRATSUKI of lighting, and will appear. In recent years, the request which is going to reduce the line voltage variation by rapid current change of such a device has become strong.

[0006]

[Problem(s) to be Solved by the Invention] In order to prevent such CHIRATSUKI of a luminaire, it is necessary to make current change loose. That is, it is necessary to reduce the rapid current change by the halogen heater used for anchorage devices, such as a copying machine. (This is also called "reduction of a flicker value" on these descriptions.) It is required to specifically ease the rapid current change parts of P1 at the time of the halogen heater energization current ON shown in <u>drawing 2</u> and the P2 section at the time of OFF.

[0007] The approach for solving this trouble is energization of HITAHE by phase control (conduction angle control) as shown in <u>drawing 3</u> . As already stated, in order to prevent a rapid current change like [ at the time of rush current generating just behind Heater ON ], that what is necessary is just to enlarge applied voltage gradually effectually, in the form shown in the heater energization current wave form of <u>drawing 3</u> , first, the resistance welding time in each half-wave length of an AC-power-supply electrical potential difference is made small, and is enlarged gradually in the beginning (t1, t2, t3, ... tn).

[0008] This approach is common knowledge and it is also possible to carry out moderate current change near a data ideal. However, the following faults also exist in the approach. 1. The timer style for deciding a phase angle etc. is considered that the hardware is complicated and the complexity on control of those setting out, starting, etc. becomes high similarly. 2. To the area (regional difference (50Hz and 60Hz)) where power line periods differ, another setting out is respectively required and there is complicatedness to carving management. 3. Since energization of HITAHE is turned on not within a zero cross origin but within the half-wave length so that clearly even if it sees <u>drawing 3</u> , a higher-harmonic current increases. This current is generated by the high order wave (several times to dozens times) of a power line period. This does active jamming as other device HENOIZU connected through the feeder, and causes malfunction and failure. Therefore, in the case of phase control, in order to reduce this higher-harmonic-wave current, the response of inserting a mass choke coil is needed separately.

[0009] Except what is depended on phase control, the technique which supplies power to a heater so that a zero crossing point LGT may be carried out at JP,9-80961,A with an alternating current discontinuous pattern which becomes power fewer than the energization power of rating according [ on-timing to predetermined time at least ] to alternating current continuation burning of the on-timing of a heater and off-timing is indicated. Moreover, the technique of the zero crossing point LGT in an anchorage device equipped with two heaters is indicated by JP,11-95611,A. By these, the rush current at the time of Heater ON can be reduced, and generating of a noise can be reduced.

[0010] Usually, in the anchorage device, in order to maintain the temperature of a heater roller to predetermined temperature, the continuous temperature control is performed. Although this predetermined temperature may change with modes of operation at the time of a copy and standby etc., ON/OFF of a heater is performed anyway by measuring the temperature of a heater roller with a predetermined value (threshold). That is, if temperature falls from a predetermined value, ON signal of a heater will be outputted, and if a predetermined value is exceeded, the OFF signal of a heater will be outputted. Although there is what the threshold at the time of a temperature rise and descent is changed for (that is, a hysteresis is given), the conventional heater control is binary control in principle anyway.

[0011] On the other hand, this invention aims at offering the new heater control approach and image formation equipment which can reduce current variation (flicker value) while it performs fine temperature control by the inside of a temperature control.

[0012]

[Means for Solving the Problem] In order to attain the above-mentioned object, the heater control approach by this invention The step which is the heater control approach at the time of driving a heater by AC power supply, and detects the temperature for [ of a heater ] heating serially, The step which judges to which temperature requirement of the four temperature requirements divided with three thresholds this detected temperature belongs, It is the energization pattern which made the period a part for the 3 half-wave lengths which supply voltage follows. The 1st energization pattern which does not have infanticide of a half wave, the 2nd energization pattern which thins out one half wave, It is characterized by having the step which controls said heater by the energization pattern which assigned the 3rd energization pattern which thins out two half waves, and the 4th energization pattern without energization to said four temperature requirements from the side with respectively low temperature, and was assigned to said judged temperature requirement.

[0013] Thus, while becoming possible to perform highly precise temperature control compared with control ON/OFF binary [ conventional ] by [ four ] dividing and assigning four different energization patterns (four values) to

each temperature requirement, reduction of the flicker value by reduction of current variation can also attain the temperature requirement for [ of a heater ] heating.

[0014] in this heater control approach, control of said heater by at least one of the said 2nd, 3rd, and 4th energization patterns is longer than at least 1 period preferably, without taking the temperature for [ said ] heating into consideration -- it set beforehand -- time amount continuation is carried out. By this, a flicker value can be further reduced compared with the case where such time amount continuation is not performed.

[0015] When the temperature threshold which makes the temperature threshold which makes the temperature threshold made to shift to the 1st energization pattern from the 2nd energization pattern shift to the 2nd energization pattern from Ta and the 3rd energization pattern in the above-mentioned heater control approach shift to the 3rd energization pattern from Tb and the 4th energization pattern is set to Tc, it is the relation of these temperature thresholds [0016] It is [0017] while considering as Ta>Tb>Tc. On the contrary, it is [0018] when the temperature threshold which the temperature threshold made to shift to the 2nd energization pattern from the 1st energization pattern is shifted to Ta', and makes the temperature threshold made to shift to the 3rd energization pattern from the 2nd energization pattern shift to the 4th energization pattern from Tb' and the 3rd energization pattern is made into Tc'. It can also consider as the relation of Ta>=Ta'Tb>=Tb'Tc>=Tc' (however, the conditions which make all these three formulas an equal sign are removed). The so-called hysteresis is given to at least one of the thresholds of the boundary of this, i.e., four temperature requirements. This also has effectiveness in reduction of a flicker value.

[0019] The step which the another heater control approach by this invention is the heater control approach at the time of driving a heater by AC power supply, and detects the temperature for [ of a heater ] heating serially, The step which judges to which temperature requirement of the seven temperature requirements divided with six thresholds this detected temperature belongs, It is the energization pattern which made the period a part for the 3 half-wave lengths which supply voltage follows. The 1st energization pattern which does not have infanticide of a half wave, the 2nd energization pattern which thins out one half wave, The inside of the 3rd energization pattern which thins out two half waves, and the 4th energization pattern without energization, The 1st combination energization pattern which combined the 1st energization pattern and the 1st energization pattern, The 2nd combination energization pattern which combined the 2nd energization pattern and the 1st energization pattern, The 3rd combination energization pattern which combined the 2nd energization pattern and the 2nd

energization pattern, The 4th combination energization pattern which combined the 3rd energization pattern and the 2nd energization pattern, The 5th combination energization pattern which combined the 3rd energization pattern and the 3rd energization pattern, The 6th combination energization pattern which combined the 4th energization pattern and the 3rd energization pattern, The 7th combination energization pattern which combined the 4th energization pattern and the 4th energization pattern It is characterized by having the step which controls said heater by the combination energization pattern which assigned said seven temperature requirements from the side with respectively low temperature, and was assigned to said judged temperature requirement. This is also an example of another multiple-value control, and the same effectiveness as the above-mentioned heater control approach is acquired.

[0020] The step which the heater control approach by this invention is the heater control approach at the time of driving a heater by AC power supply according to another viewpoint, and detects the temperature for [ of a heater ] heating serially, The step which judges to which temperature requirement of the n temperature requirements (n is three or more integers) divided with the threshold of an individual (n-1) this detected temperature belongs, 1 or two or more energization patterns which made the period a part for m half-wave length which supply voltage follows (m is three or more odd number) are used as a unit energization pattern. It is characterized by having the step which energizes said heater by the energization pattern which assigned the n-th unit energization pattern to a side with respectively low temperature to said n temperature requirements from the 1st used as the sequential size of the number of infanticide of a half wave, and was assigned to said judged temperature requirement.

[0021] The equipment for enforcing the heater control approach of this invention The fixing heater which is image formation equipment which has the anchorage device which fixes a toner image on a form, and is built in said anchorage device, A switching means to control the impression of an AC-power-supply electrical potential difference to this heater, A means to judge to which temperature requirement of the n temperature requirements (n is three or more integers) divided with the threshold of an individual (n-1) the temperature detected by temperature detection means to detect the temperature of said fixing heater, and said temperature detection means belongs, 1 or two or more energization patterns which made the period a part for m half-wave length which supply voltage follows (m is three or more odd number) are used as a unit energization pattern. It is characterized by having the control means which controls said switching means by the energization pattern which assigned the n-th unit energization pattern to a side with respectively low temperature to said n temperature requirements from the

1st used as the sequential size of the number of infanticide of a half wave, and was assigned to said judged temperature requirement.

[0022]

[Embodiment of the Invention] Hereafter, the gestalt of suitable operation of this invention is explained to a detail.

[0023] First, the concept of this invention is explained. The approach of this invention can offer the heater control approach which can raise control precision more to the conventional heater ON/OFF (binary) control, and, thereby, can reduce a flicker value effectively. This heater control approach will be called "multiple-value proportional control."

[0024] The gestalt of one suitable operation is 4 value proportional control using the energization pattern of four values (0, 1/3, 2/3, 3/3) acquired by thinning out the half wave of the number which makes the 3 half-wave length one period, and is different from this one period. In this control, as shown in drawing 5 (a), three boundary values (threshold) which change four values are set to Ta, Tb, and Tc, and these relation is set as Ta>Tb>Tc. (For example, Tb is made into the target temperature at the time of a ** print or a copy.) To four temperature requirements divided with these boundary values, as shown in drawing 5 (b), the applied-voltage pattern (energization pattern) of one period which thinned out the half wave of the number of infanticide different, respectively is assigned. Supposing it carries out change as temperature shows to drawing 5 (a), four value energization patterns (energization condition) will change one by one like 3/3 ->2/3 ->1/3 ->0/3 ->1/3 ->2/3 ->3/3. Drawing 5 (c) shows each energization pattern of these four values.

[0025] In addition, drawing 5 (a) does not show the temperature change of the actual heater roller 1 ( drawing 1 ), and shows response relation with four energization patterns. But since the temperature of the heater roller 1 changes comparatively gently, you may think that change of electrical-potential-difference impression of heater 4 HE is produced gradually (difference every 3 [ 1/]). Therefore, it can be said that relaxation of a rapid current change is made by this approach.

[0026] It is also possible to apply the energization pattern which the aforementioned fundamental 4 value proportional control was developed, and was divided more into the multiple value. For example, the approach using the combination energization pattern which made the set a part for 2 of 3 half-wave length periods periods as a unit energization pattern is shown in drawing 6 as a gestalt of operation of the 2nd of this invention. In this case, six half waves become one period of a unit energization pattern.

[0027] Specifically, the condition of the seven following values is shown. (1) The combination (0/6) energization pattern which combined (0/6) with no energizing (0/6), (2) The combination (1/6) energization pattern which

combined (0/3) with energization (1/3), (3) The combination (2/6) energization pattern which combined (1/3) with energization (1/3), (4) The combination (3/6) energization pattern which combined (1/3) with energization (2/3), (5) Combined (3/3) with the combination (4/6) energization pattern which combined (2/3) with energization (2/3), the combination (5/6) energization pattern which combined (2/3) with (6) energization (3/3), and (7) energization (3/3), namely, it is the combination (6/6) energization pattern of all energization.

[0028] Thus, the proportional control of a unit energization pattern, then seven values becomes possible about a part for 2 of 3 half-wave length periods periods (a part for the 6 half-wave length). Similarly, the phase of a set pattern, then ten values is acquired in a part for 3 of 3 half-wave length periods periods (a part for the 9 half-wave length). Furthermore, by increasing a period, a multiple value can be obtained more. Also in the form which used a part for a term (a part for the multiple for the 3 half-wave length) as the unit energization pattern such two or more rounds, since each current change will be set to one third if it compares with all mere energization ON/OFF, it is committed in the direction which reduces the rapid current change by heater energization.

[0029] Furthermore, an idea is advanced and CHIRATSUKI is explained for human being as the 1st modification of the gestalt of this operation of the approach of avoiding current change on a sensitive frequency (near 8Hz). What is necessary is just to move more the switch frequency to each condition of energization change 3/3 ->2/3 ->1/3 ->0 ->1/3 ->2/3 ->3/3 explained by drawing 5 in the low-pass direction from near 8Hz. That is, if the time amount (the number of 3 half-wave-length periods) which piles up in each condition of each energization pattern (1/3), (2/3), and (3/3) by carrying out the switch temperature Ta of each energization PATANHE and the difference of Tb, Tb, and Tc to beyond a predetermined value is managed so that it may become beyond a predetermined value compulsorily, current change frequency can be reduced and a change frequency can be moved more to low-pass. For example, in the experiment by this invention person who it was referred to [ person ] as Ta=186-degreeC, Tb=185-degreeC, and Tc=184-degreeC, and changed the minimum compulsive residence time (the minimum duration time) from 1 of 3 half-wave length periods period (three half waves) to eight periods (24 half waves) for every period about the halogen heater of 230V and 800W, the flicker value (Pst) measured in flicker meter carried out sequential lowering from 1.01 to 0.67. It is the flicker assessment value of the short time (for 10 minutes) as which Pst (Period Short Time) was determined here by the specification of EN 61000-3-3, for example, is EMC. It is indicated by 35th page - page [ 41st ] "the voltage variation and flicker measurement" of 1995.10.5 (No.90).

[0030] However, the responsibility of temperature control worsens and fluctuation of the temperature of a heater roller becomes large, so that the minimum duration time becomes long. Therefore, although it is desirable to carry out to more than 2 periods (6 half-wave length) as for the minimum duration time, if responsibility is also taken into consideration, 4 period order is desirable. That is, even if temperature control fluctuation becomes large somewhat compared with the case where the minimum duration time is one period, if it restricts to the range which does not spoil fixable, a flicker value can be reduced further.

[0031] In addition, the actual switch frequency of an energization condition is not decided by the above-mentioned minimum duration time, and serves as a frequency lower than the frequency converted by the minimum duration time for [, such as the heat history of a heater, ] effect.

[0032] As the 2nd modification of the gestalt of this operation, how to give thermal hysteresis is considered about Ta, Tb, and Tc. The temperature threshold when shifting to energization (0/3) from energization (1/3) For example, Ta, Tb and the temperature threshold of (3/3 ->2 / 3) are set to Tc for the temperature threshold of ** (2/3 ->1/3), and Tb' and the temperature threshold of (2/3 ->3 / 3) are determined [ the temperature threshold of (0/3 ->1 / 3) of hard flow ] for Ta' and the temperature threshold of (1/3 ->2 / 3) as Tc' to this. At this time, it is [0033]. It considers as the relation of Ta>=Ta', Tb>=Tb', and Tc>=Tc' (however, the conditions which make all these three formulas an equal sign are removed).

[0034] Thus, a fluctuation frequency frequency can be moved in the low-pass direction by being easy to maintain the duration time of each energization pattern. Although this 2nd modification is employable independently of the 1st modification, it is also possible to use both modifications together. moreover, both modifications -- both -- again -- ** -- it is [ in / it is independent and / the gestalt of implementation of the above 2nd ] employable.

[0035] All were based on 3 half-wave length periods in the above example. Here, the advantage of applying wave number infanticide on the basis of 3 half-wave length periods is explained briefly. For example, since it will become the same dc component as a half-wave rectification wave if one period of an energization pattern is seen as the 2 half-wave lengths (one period of a sine wave form), and it will thin out by the 1 half-wave length from now on, the control top problem of a halogen heater is large. Moreover, infanticide with a period longer than 3 half-wave length periods becomes sensitive as CHIRATSUKI on the property of CHIRATSUKI, such as lighting, at the eyes of the infanticide actuation itself and a man. Therefore, it will be said that it is appropriate to think, the shortest periods, i.e., 3 half-wave length periods, other than 2 half-wave length periods. In fact, in infanticide of

this 3 half-wave-length period, most of the place which connected lighting actually and observed CHIRATSUKI, and a feeling of CHIRATSUKI was not sensed.

[0036] However, it is also possible to make the half wave of the odd number of 5 and 7 grades into a criteria period. In such a case, if compared with 3 half-wave length periods, though effectiveness will fall in respect of CHIRATSUKI, in addition, the effectiveness of reduction of current variation is accepted. The number of the temperature threshold in the case of m half-wave length period (m is three or more odd number) turns into the same number m.

[0037] Drawing 7 is the circuit diagram of the control circuit for realizing "wave number control" of the gestalt of this operation mentioned above.

[0038] TH in this drawing is a thermistor temperature sensor (5 in drawing 1 ) which detects the temperature of a heater roller (1 in drawing 1 ). This sensor TH is connected to resistance R1, and that partial pressure potential is inputted into analog input terminal A/D in a central processing unit CPU. Analog-to-digital conversion of the signal given to the A/D terminal is carried out, and it is processed within CPU. The zero cross pulse generated in the zero crossing point of supply voltage is inputted into the interruption input terminal INT of CPU. The generating circuit of this zero cross pulse is constituted by the photo coupler PC of the upper part of drawing 7 and Comparator COM, resistance R5-R10, and Diode D.

[0039] According to falling of a zero cross pulse, the interruption routine inside CPU (after-mentioned) is started, and the signal OUT which makes Heater HT (4 in drawing 1 ) turn on or switch off immediately after this zero cross signal falling is outputted. For example, when an OUT output is H level, Transistor TR was set to OFF and the luminescence side of phot triac PT has gone out. Since the light-receiving side of phot triac PT is also OFF at this time, the gate current of Triac T does not flow. Therefore, Triac T will be in an OFF condition and a heater will be switched off. Reversely, when OUT is LOW level, reversely, actuation of above-mentioned reverse is carried out, TR turns on the light emitting diode of ON and PT, and a phot triac PT light-receiving side turns on. Since a phot triac PT light-receiving side flows through GETOHE of Triac T, the gate current the ** style was carried out [ gate current ] by resistance R2 or R3 is supplied. Therefore, Triac T is flowed through it and turns on a heater. It is a snubber circuit, and when R4 and C1 which were connected to juxtaposition at T have the abrupt change of supply voltage under the effect of an outpatient department noise etc., it is for preventing that Triac T turns on independently.

[0040] Drawing 5 explains again the process of the heater control in the gestalt of this operation by the circuit of this drawing 7 . Three thresholds which gave the relation of Ta>Tb>Tc for control temperature as illustrated

first are set up. When the temperature detection signal inputted into the A/D terminal in drawing 7 is below Tc, all energization patterns (3/3) are given to a heater and temperature becomes the range of Tb>=T>Tc, an energization pattern (2/3) is given to a heater. Furthermore, when temperature rises and it is set to the level of Ta>=T>Tb, heater energization power is reduced more and an energization pattern (1/3) is impressed. When temperature serves as T>=Ta, a non-energized pattern (0/3) is given. When temperature has fallen, the process of the aforementioned reverse is followed and it is made to increase the power of energization (1/3) -> energization (2/3) -> energization (3/3) and a heater with temperature (the process of (b) is shown in drawing 5 .).

[0041] The actual temperature control (temperature control) condition under standby to drawing 8 and print (copy) is shown. If the mean power under standby is 1/3 or less [ of all heater power ], temperature balances in the form which goes back and forth between energization (0/3) and energization (1/3). Moreover, if the mean power under print is between (2/3) with (one third) of all heater power, temperature will balance in the form where during energization (1/3) and energization (2/3) is gone back and forth. As illustrated, when the switch frequency of an energization condition is high, to a flicker value, it works disadvantageously. Therefore, as an example for which this frequency is reduced, when it rushes into a certain energization condition, as mentioned above, it is possible to define the minimum duration time which stops at that condition, and to reduce this frequency by things.

[0042] At the time of the first equipment power source ON included in a standby condition, it is energized (3/3) and the rush current may occur so that drawing 8 may show. However, once temperature reaches the maximum threshold Ta, from energization (0/3), energization (3/3) is surely reached via energization (1/3) and (2/3). That is, it can be said that this invention is turned to the heater control at the time of temperature control other than the time of equipment power-source ON. In order to cope with the rush current at the time of the equipment power source ON, immediately after the equipment power source ON may adopt the above conventional technique.

[0043] The flow chart over drawing 9 and drawing 10 explains the software procedure for realizing said control. Here, let the case where the minimum duration time is set to a predetermined value on the basis of 3 half-wave length periods be an example.

[0044] since the zero cross pulse is given from said zero cross pulse generating circuit to the interruption input terminal INT to CPU ( drawing 7 ) -- every [ of this pulse ] generating (pulse falling) -- the processing in CPU -- interrupting (INT) -- the flow procedure which starts and begins from drawing 9 is performed.

[0045] First, the temperature sample flag (a flag is expressed with F in the following and drawing 9 , and drawing 10 ) which directs the timing which should carry out the sample of the heater roller temperature by the decision step S1 is investigated. Set of this flag and reset are performed at the step mentioned later. If this flag is set, Y side HEFURO of S1 will shift and the sample of the temperature T will be carried out (S19). Subsequently, the range where temperature T belongs by the decision steps S2 and S3 and S4 is judged, and it moves to a corresponding details flow.

[0046] If it is T>Ta at the decision step S2, it will shift to the Y side and, specifically, only the energization status flags 0/3F will be set among the energization status flag group 0 / 1 / 2 / 3 [ 3F and ]/3F. [ 3F and 1 ] [ 3F and 2 ] And it shifts to a juncture (d).

[0047] If it is Ta>=T>Tb at the decision step S3, it will shift to the Y side and it will be confirmed whether the energization status flags 1/3F are already set (S6). A continuation counter is started if not set (S23). This continuation counter is for measuring the minimum duration time mentioned above. Subsequently, the energization status flags 1/3F are set, and all other energization status flags (1/2 / 3 [ 3F and ]/3F) are reset (S24). [ 3F and 2 ] Also when the energization status flags 1/3F are already set at the decision step S6, this step S24 is performed for a sense.

[0048] If it is Tb>=T>Tc in decision step S4, it will shift to the Y side and it will be confirmed whether the energization status flags 2/3F are already set (S7). A continuation counter is started if not set (S25). Subsequently, the energization status flags 2/3F are set, and all other energization status flags (0/1 / 3 [ 3F and ]/3F) are reset (S26). [ 3F and 1 ] Also when the energization status flags 2/3F are already set at the decision step S7, this step S26 is performed for a sense.

[0049] If it is not Tb>=T>Tc in decision step S4 (i.e., if it is Tc>=T), it will shift to the Y side and it will be confirmed whether the energization status flags 3/3F are already set (S8). A continuation counter is started if not set (S27). Subsequently, the energization status flags 3/3F are set, and all other energization status flags (0/1 / 2 [ 3F and ]/3F) are reset (S28). [ 3F and 1 ] Also when the energization status flags 3/3F are already set at the decision step S8, this step S28 is performed for a sense.

[0050] Following said S22, S24, S26, and S28, when the temperature sample F is not set at the decision step S1 mentioned above, an infanticide counter is incremented (S20). The increment of the infanticide counter is carried out for every interruption, and if the value is set to 3, it will be reset by (S9) and 0 (S21). Therefore, the value of an infanticide counter is 0->1->2->0->... It goes round in a form. This infanticide counter is for managing wave number infanticide timing by supervising that value by consecutive processing. That is, it shifts to the decision steps S10, S11, S12, and S13 of drawing 10 , and the interruption corresponds to which half wave in 3 half waves, and it judges

[ which turns on the half wave concerned according to the established state of each energization status flag at the event / or or ] whether OFF is carried out, and the output of a control signal is directed.

[0051] At the decision step S10, the existence of the set of the energization status flags 0/3F is seen, if it is Yes, it will thin out, and it is not concerned with the value of a counter, but an output signal OUT is turned on, and, specifically, a heater is switched off (S31).

[0052] At the decision step S11, the existence of the set of the energization status flags 1/3F is investigated, if it is Yes, it will thin out, only when a counter is 0, a heater is turned on (S33), and (S14, Yes) when other, it turns off (S32). only one half wave in 3 half waves is set to 4 with ON and 2 half-wave infanticide.

[0053] At the decision step S12, the existence of the set of the energization status flags 2/3F is investigated, if it is Yes, it will thin out, only when a counter is 2, a heater is turned off (S35), and (S15, Yes) when other, a heater is turned on (S34). That is, it will thin out 1 half wave of the three half waves (when an infanticide counter is 2).

[0054] At the decision step S13, the existence of the set of the energization status flags 3/3F is investigated, if it is Yes, it will not be concerned with the value of an infanticide counter, but a heater will be set to ON (S36). That is, a heater serves as all energization. If a decision result is No at the decision step S13, the temperature sample F will be set (S37) and this interruption processing will be ended (a return is carried out). Step S37 is for coping with it, when neither of the energization status flags is set by some reasons of an initial event etc.

[0055] At the decision step S16 following ON/OFF setting out of each heater of S31-S36, an infanticide counter value is investigated and that it is the break (the last half wave) of 3 half-wave length periods, i.e., an infanticide counter value, investigates whether it is 2. If it is not the location of such a break, the return of the temperature sample F will be reset and (S39) carried out.

[0056] It thins out at the decision step S16, and when a counter is 2 (i.e., when it comes to the break (the last half wave) of 3 half-wave length periods), a continuation counter investigates whether it is under [ count ] ****** at the following decision step S17. During a count of a continuation counter, what the continuation counter started by either of previous steps S23, S25, and S27 is meant. A continuation counter will be incremented if it is under count (S38). This continuation counter is set up in order to maintain an energization condition beyond fixed time amount (multiple of 3 half-wave length periods) compulsorily, as mentioned above. If this continuation counter has not reached a predetermined value (S18, No), it shifts to a juncture (g). Here, the temperature sample F is reset (S39). Therefore, in the following

interruption cycle, a temperature sample is not made, but will be thinned out and the wave number infanticide energization based on a counter value will be maintained succeedingly. Thus, the minimum duration time of an energization condition is managed with the continuation counter.

[0057] A continuation counter is stopped when the continuation counter has reached the predetermined value in S18 (S40). Moreover, it directs to perform a temperature sample at the beginning of (S41) and the following interruption routine, and to switch an energization condition according to a temperature sample by setting the temperature sample F.

[0058] The sample of the temperature T will be carried out (S19), it will shift to the Y side at step S1 at the beginning of the following interruption routine after the temperature sample F was set at step S41 ( drawing 9 ), and the temperature T will be investigated. For example, if temperature is in Ta>=T>Tb, it will flow to the Y side of the decision step S3, and will judge whether the energization status flag before set at step S6 is the same as the energization status flags 1/3F to be set from now on. not starting a continuation counter and having made it stop freely, when the same -- carrying out -- said -- only 1/3F are set (S24), and it is made to shift to the next juncture (d) Henceforth, since 2 half-wave infanticide was made between 3 half-wave-length periods and Y side) and a continuation counter have already stopped by the break of 3 half-wave length periods (S16, processing shift is carried out by S17 at the N side, and temperature Sun Bull F is set again (S41).

[0059] If it flowed to the Y side at the decision step S1 similarly at the time of the next interruption routine initiation, for example, temperature passed decision step S4 by Tb>=T>Tc, it considers that it has a switch of an energization condition at the decision step S7 since the last energization condition F was 1/3F, processing shift is carried out to the N side, and a continuation counter is started (S25), and 2/3F are set (S26). This 2/3 energization would be directed to the continuation counter at least, and will carry out time amount continuation.

[0060] In the decision step S2, the last flag is not investigated by the Y side, there are no start directions of a continuation counter, and the minimum duration time of the energization F (0/3F) set here is not specified. That is, with the gestalt of this operation, continuation exceeding 3 half-wave length periods is not intentionally directed to 0 / 3 energization condition. Since full putting out lights of a fixing heater of continuing from a viewpoint of fixable [ to a form ] is not desirable, compulsory continuity is made into the condition that there dares be nothing.

[0061] The following matters are mentioned as a merit of the gestalt of this operation of 3 half-wave length criteria expressed above.

[0062] (1) The energization which does not have infanticide of a half wave by

making into a period a part for the 3 half-wave lengths which supply voltage follows (3/3), Four steps of energization patterns [ having the energization which thins out one half wave by making the 3 half-wave lengths into a period (2/3), the energization which thins out two half waves (1/3), and no energization (0/3) ] by 4 value control matched with the quadrisection range of the temperature for heating of a heater, respectively Compared with the conventional binary control, the temperature control of finer high degree of accuracy can be attained.

[0063] Simultaneously, in a continuous temperature control, since change (difference) of an energization condition is always a part for a half wave per 1/3 (refer to drawing 8 ), 1 [ i.e., ], period, a rapid current change of heater energization can be reduced effectively.

[0064] (2) Moreover, control hardware is comparatively simple. For example, in the case of a phase control method which was mentioned above, it is necessary to generate the pulse which specifies the phase angle which should set up a timer from the zero crossing point of supply voltage, and should turn on a heater. These must prepare hardware, such as the complexity of the control [ itself ], and a timer style. On the other hand, if it is "wave number control", since it is only turning on a heater on a zero cross origin, the timer which determines a phase becomes unnecessary. Moreover, the complexity on control, such as those setting out and starting, decreases that much.

[0065] (3) Further, since the heater current in "wave number control" is impressed from a zero cross origin, it does not almost have a high order frequency current change of the power line period on a power-source line, and generating of the so-called power-source higher harmonic. Usually, such a problem is solved by the gestalt of this operation, although the mass inductance (choke coil) was inserted in the heater and the serial and it had become a failure over miniaturization of the machine by reservation of cost lifting by addition of an excessive electrical part, and its installation, in order to suppress generating of such a power-source higher harmonic wave.

[0066] As mentioned above, although the gestalt of suitable operation of this invention was explained, various deformation and modification are possible.

[0067]

[Effect of the Invention] According to this invention, by performing different multiple-value control from binary control, while the inside of a temperature control performs fine temperature control, current variation (flicker value) can be reduced.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention] This invention relates to the heater control approach and image formation equipment which can reduce the rapid current variation at the time of energization of the heater for a temperature control especially mainly about heater control of the anchorage device built in image formation equipments, such as an electrostatic copying machine and a printer.

[Translation done.]

## PRIOR ART

[Description of the Prior Art] Conventionally, the halogen lamp with the comparatively large consumed electric current is used for this kind of heater, and big current variation, such as the rush current, occurs at the time of that ON.

[0003] Drawing 1 shows the schematic diagram of a fixing roller. A fixing roller has the heater roller 1 having a heater 4, and the application-of-pressure roller 2 pressurized to this heater roller 1. Thermal melting arrival of the toner image developed on the form 3 is carried out on a form 3 by passing a form 3 between both this roller 1 and 2.

[0004] Drawing 2 shows the heater energization current wave form at the time of the conventional ON/OFF control for the temperature control of the heater roller 1. In this wave, the OFF condition of a heater and ON condition change and P1 and the P2 section are the rapid current change parts corresponding to an event. This current variation produced the voltage variation of the supply power source itself, and has caused CHIRATSUKI, such as lighting connected to the same power source. That is, generally, as shown in drawing 4 , when the supply power source AC is seen from the outside of a power receptacle, the comparatively small source impedance Rs exists. For this reason, when the consumed electric current of the connection device (here copying machine) D to a power source AC changes suddenly a lot, it originates in the voltage drop by source impedance Rs, and fluctuation of supply voltage occurs. deltaI, then rapid line-voltage-variation part deltaV are expressed with a degree type in a rapid current change.

[0005] deltaV=Rs x If Luminaire L is connected to deltaI, for example, this plug socket line, rapid line voltage variation will serve as CHIRATSUKI of lighting, and will appear. In recent years, the request which is going to reduce the line voltage variation by rapid current change of such a device has become strong.

## EFFECT OF THE INVENTION

[Effect of the Invention] According to this invention, by performing different multiple-value control from binary control, while the inside of a temperature control performs fine temperature control, current variation (flicker value) can be reduced.

[Translation done.]

## TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] In order to prevent such
CHIRATSUKI of a luminaire, it is necessary to make current change loose.
That is, it is necessary to reduce the rapid current change by the halogen
heater used for anchorage devices, such as a copying machine. (This is also
called "reduction of a flicker value" on these descriptions.) It is required to
specifically ease the rapid current change parts of P1 at the time of the
halogen heater energization current ON shown in drawing 2 and the P2
section at the time of OFF.

[0007] The approach for solving this trouble is energization of HITAHE by
phase control (conduction angle control) as shown in drawing 3 . As already
stated, in order to prevent a rapid current change like [ at the time of rush
current generating just behind Heater ON ], that what is necessary is just to
enlarge applied voltage gradually effectually, in the form shown in the heater
energization current wave form of drawing 3 , first, the resistance welding
time in each half-wave length of an AC-power-supply electrical potential
difference is made small, and is enlarged gradually in the beginning (t1, t2, t3,
... tn).

[0008] This approach is common knowledge and it is also possible to carry
out moderate current change near a data ideal. However, the following faults
also exist in the approach. 1. The timer style for deciding a phase angle etc.
is considered that the hardware is complicated and the complexity on control
of those setting out, starting, etc. becomes high similarly. 2. To the area
(regional difference (50Hz and 60Hz)) where power line periods differ,
another setting out is respectively required and there is complicatedness to
carving management. 3. Since energization of HITAHE is turned on not within
a zero cross origin but within the half-wave length so that clearly even if it
sees drawing 3 , a higher-harmonic current increases. This current is
generated by the high order wave (several times to dozens times) of a power
line period. This does active jamming as other device HENOIZU connected

through the feeder, and causes malfunction and failure. Therefore, in the
case of phase control, in order to reduce this higher-harmonic-wave current,
the response of inserting a mass choke coil is needed separately.

[0009] Except what is depended on phase control, the technique which
supplies power to a heater so that a zero crossing point LGT may be carried
out at JP,9-80961,A with an alternating current discontinuous pattern which
becomes power fewer than the energization power of rating according [
on-timing to predetermined time at least ] to alternating current continuation
burning of the on-timing of a heater and off-timing is indicated. Moreover,
the technique of the zero crossing point LGT in an anchorage device
equipped with two heaters is indicated by JP,11-95611,A. By these, the rush
current at the time of Heater ON can be reduced, and generating of a noise
can be reduced.

[0010] Usually, in the anchorage device, in order to maintain the temperature
of a heater roller to predetermined temperature, the continuous temperature
control is performed. Although this predetermined temperature may change
with modes of operation at the time of a copy and standby etc., ON/OFF of
a heater is performed anyway by measuring the temperature of a heater
roller with a predetermined value (threshold). That is, if temperature falls
from a predetermined value, ON signal of a heater will be outputted, and if a
predetermined value is exceeded, the OFF signal of a heater will be
outputted. Although there is what the threshold at the time of a temperature
rise and descent is changed for (that is, a hysteresis is given), the
conventional heater control is binary control in principle anyway.

[0011] On the other hand, this invention aims at offering the new heater
control approach and image formation equipment which can reduce current
variation (flicker value) while it performs fine temperature control by the
inside of a temperature control.

[Translation done.]

**\* NOTICES \***

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.\*\*\*\* shows the word which can not be translated.
3.In the drawings, any words are not translated.

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MEANS

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[Means for Solving the Problem] In order to attain the above-mentioned object, the heater control approach by this invention The step which is the heater control approach at the time of driving a heater by AC power supply, and detects the temperature for [ of a heater ] heating serially, The step which judges to which temperature requirement of the four temperature requirements divided with three thresholds this detected temperature belongs, It is the energization pattern which made the period a part for the 3 half-wave lengths which supply voltage follows. The 1st energization pattern which does not have infanticide of a half wave, the 2nd energization pattern which thins out one half wave, It is characterized by having the step which controls said heater by the energization pattern which assigned the 3rd energization pattern which thins out two half waves, and the 4th energization pattern without energization to said four temperature requirements from the side with respectively low temperature, and was assigned to said judged temperature requirement.

[0013] Thus, while becoming possible to perform highly precise temperature control compared with control ON/OFF binary [ conventional ] by [ four ] dividing and assigning four different energization patterns (four values) to each temperature requirement, reduction of the flicker value by reduction of current variation can also attain the temperature requirement for [ of a heater ] heating.

[0014] in this heater control approach, control of said heater by at least one of the said 2nd, 3rd, and 4th energization patterns is longer than at least 1 period preferably, without taking the temperature for [ said ] heating into consideration -- it set beforehand -- time amount continuation is carried out. By this, a flicker value can be further reduced compared with the case where such time amount continuation is not performed.

[0015] When the temperature threshold which makes the temperature threshold which makes the temperature threshold made to shift to the 1st

energization pattern from the 2nd energization pattern shift to the 2nd energization pattern from Ta and the 3rd energization pattern in the above-mentioned heater control approach shift to the 3rd energization pattern from Tb and the 4th energization pattern is set to Tc, it is the relation of these temperature thresholds [0016] It is [0017] while considering as Ta>Tb>Tc. On the contrary, it is [0018] when the temperature threshold which the temperature threshold made to shift to the 2nd energization pattern from the 1st energization pattern is shifted to Ta', and makes the temperature threshold made to shift to the 3rd energization pattern from the 2nd energization pattern shift to the 4th energization pattern from Tb' and the 3rd energization pattern is made into Tc'. It can also consider as the relation of Ta>=Ta'Tb>=Tb'Tc>=Tc' (however, the conditions which make all these three formulas an equal sign are removed). The so-called hysteresis is given to at least one of the thresholds of the boundary of this, i.e., four temperature requirements. This also has effectiveness in reduction of a flicker value.

[0019] The step which the another heater control approach by this invention is the heater control approach at the time of driving a heater by AC power supply, and detects the temperature for [ of a heater ] heating serially, The step which judges to which temperature requirement of the seven temperature requirements divided with six thresholds this detected temperature belongs, It is the energization pattern which made the period a part for the 3 half-wave lengths which supply voltage follows. The 1st energization pattern which does not have infanticide of a half wave, the 2nd energization pattern which thins out one half wave, The inside of the 3rd energization pattern which thins out two half waves, and the 4th energization pattern without energization, The 1st combination energization pattern which combined the 1st energization pattern and the 1st energization pattern, The 2nd combination energization pattern which combined the 2nd energization pattern and the 1st energization pattern, The 3rd combination energization pattern which combined the 2nd energization pattern and the 2nd energization pattern, The 4th combination energization pattern which combined the 3rd energization pattern and the 2nd energization pattern, The 5th combination energization pattern which combined the 3rd energization pattern and the 3rd energization pattern, The 6th combination energization pattern which combined the 4th energization pattern and the 3rd energization pattern, The 7th combination energization pattern which combined the 4th energization pattern and the 4th energization pattern It is characterized by having the step which controls said heater by the combination energization pattern which assigned said seven temperature requirements from the side with respectively low temperature, and was assigned to said judged temperature requirement. This is also an example of

another multiple-value control, and the same effectiveness as the above-mentioned heater control approach is acquired.

[0020] The step which the heater control approach by this invention is the heater control approach at the time of driving a heater by AC power supply according to another viewpoint, and detects the temperature for [ of a heater ] heating serially, The step which judges to which temperature requirement of the n temperature requirements (n is three or more integers) divided with the threshold of an individual (n-1) this detected temperature belongs, 1 or two or more energization patterns which made the period a part for m half-wave length which supply voltage follows (m is three or more odd number) are used as a unit energization pattern. It is characterized by having the step which energizes said heater by the energization pattern which assigned the n-th unit energization pattern to a side with respectively low temperature to said n temperature requirements from the 1st used as the sequential size of the number of infanticide of a half wave, and was assigned to said judged temperature requirement.

[0021] The equipment for enforcing the heater control approach of this invention The fixing heater which is image formation equipment which has the anchorage device which fixes a toner image on a form, and is built in said anchorage device, A switching means to control the impression of an AC-power-supply electrical potential difference to this heater, A means to judge to which temperature requirement of the n temperature requirements (n is three or more integers) divided with the threshold of an individual (n-1) the temperature detected by temperature detection means to detect the temperature of said fixing heater, and said temperature detection means belongs, 1 or two or more energization patterns which made the period a part for m half-wave length which supply voltage follows (m is three or more odd number) are used as a unit energization pattern. It is characterized by having the control means which controls said switching means by the energization pattern which assigned the n-th unit energization pattern to a side with respectively low temperature to said n temperature requirements from the 1st used as the sequential size of the number of infanticide of a half wave, and was assigned to said judged temperature requirement.

[0022]
[Embodiment of the Invention] Hereafter, the gestalt of suitable operation of this invention is explained to a detail.

[0023] First, the concept of this invention is explained. The approach of this invention can offer the heater control approach which can raise control precision more to the conventional heater ON/OFF (binary) control, and, thereby, can reduce a flicker value effectively. This heater control approach will be called "multiple-value proportional control."

[0024] The gestalt of one suitable operation is 4 value proportional control using the energization pattern of four values (0, 1/3, 2/3, 3/3) acquired by thinning out the half wave of the number which makes the 3 half-wave length one period, and is different from this one period. In this control, as shown in drawing 5 (a), three boundary values (threshold) which change four values are set to Ta, Tb, and Tc, and these relation is set as Ta>Tb>Tc. (For example, Tb is made into the target temperature at the time of a ** print or a copy.) To four temperature requirements divided with these boundary values, as shown in drawing 5 (b), the applied-voltage pattern (energization pattern) of one period which thinned out the half wave of the number of infanticide different, respectively is assigned. Supposing it carries out change as temperature shows to drawing 5 (a), four value energization patterns (energization condition) will change one by one like 3/3 ->2/3 ->1/3 ->0/3 ->1/3 ->2/3 ->3/3. Drawing 5 (c) shows each energization pattern of these four values.

[0025] In addition, drawing 5 (a) does not show the temperature change of the actual heater roller 1 ( drawing 1 ), and shows response relation with four energization patterns. But since the temperature of the heater roller 1 changes comparatively gently, you may think that change of electrical-potential-difference impression of heater 4 HE is produced gradually (difference every 3 [ 1/]). Therefore, it can be said that relaxation of a rapid current change is made by this approach.

[0026] It is also possible to apply the energization pattern which the aforementioned fundamental 4 value proportional control was developed, and was divided more into the multiple value. For example, the approach using the combination energization pattern which made the set a part for 2 of 3 half-wave length periods periods as a unit energization pattern is shown in drawing 6 as a gestalt of operation of the 2nd of this invention. In this case, six half waves become one period of a unit energization pattern.

[0027] Specifically, the condition of the seven following values is shown. (1) The combination (0/6) energization pattern which combined (0/6) with no energizing (0/6), (2) The combination (1/6) energization pattern which combined (0/3) with energization (1/3), (3) The combination (2/6) energization pattern which combined (1/3) with energization (1/3), (4) The combination (3/6) energization pattern which combined (1/3) with energization (2/3), (5) Combined (3/3) with the combination (4/6) energization pattern which combined (2/3) with energization (2/3), the combination (5/6) energization pattern which combined (2/3) with (6) energization (3/3), and (7) energization (3/3), namely, it is the combination (6/6) energization pattern of all energization.

[0028] Thus, the proportional control of a unit energization pattern, then seven values becomes possible about a part for 2 of 3 half-wave length periods periods (a part for the 6 half-wave length). Similarly, the phase of a

set pattern, then ten values is acquired in a part for 3 of 3 half-wave length periods periods (a part for the 9 half-wave length). Furthermore, by increasing a period, a multiple value can be obtained more. Also in the form which used a part for a term (a part for the multiple for the 3 half-wave length) as the unit energization pattern such two or more rounds, since each current change will be set to one third if it compares with all mere energization ON/OFF, it is committed in the direction which reduces the rapid current change by heater energization.

[0029] Furthermore, an idea is advanced and CHIRATSUKI is explained for human being as the 1st modification of the gestalt of this operation of the approach of avoiding current change on a sensitive frequency (near 8Hz). What is necessary is just to move more the switch frequency to each condition of energization change 3/3 ->2/3 ->1/3 ->0 ->1/3 ->2/3 ->3/3 explained by underline drawing 5 in the low-pass direction from near 8Hz. That is, if the time amount (the number of 3 half-wave-length periods) which piles up in each condition of each energization pattern (1/3), (2/3), and (3/3) by carrying out the switch temperature Ta of each energization PATANHE and the difference of Tb, Tb, and Tc to beyond a predetermined value is managed so that it may become beyond a predetermined value compulsorily, current change frequency can be reduced and a change frequency can be moved more to low-pass. For example, in the experiment by this invention person who it was referred to [ person ] as Ta=186-degreeC, Tb=185-degreeC, and Tc=184-degreeC, and changed the minimum compulsive residence time (the minimum duration time) from 1 of 3 half-wave length periods period (three half waves) to eight periods (24 half waves) for every period about the halogen heater of 230V and 800W, the flicker value (Pst) measured in flicker meter carried out sequential lowering from 1.01 to 0.67. It is the flicker assessment value of the short time (for 10 minutes) as which Pst (Period Short Time) was determined here by the specification of EN 61000-3-3, for example, is EMC. It is indicated by 35th page - page [ 41st ] "the voltage variation and flicker measurement" of 1995.10.5 (No.90).

[0030] However, the responsibility of temperature control worsens and fluctuation of the temperature of a heater roller becomes large, so that the minimum duration time becomes long. Therefore, although it is desirable to carry out to more than 2 periods (6 half-wave length) as for the minimum duration time, if responsibility is also taken into consideration, 4 period order is desirable. That is, even if temperature control fluctuation becomes large somewhat compared with the case where the minimum duration time is one period, if it restricts to the range which does not spoil fixable, a flicker value can be reduced further.

[0031] In addition, the actual switch frequency of an energization condition is not decided by the above-mentioned minimum duration time, and serves as a frequency lower than the frequency converted by the minimum duration time for [, such as the heat history of a heater, ] effect.

[0032] As the 2nd modification of the gestalt of this operation, how to give thermal hysteresis is considered about Ta, Tb, and Tc. The temperature threshold when shifting to energization (0/3) from energization (1/3) For example, Ta, Tb and the temperature threshold of (3/3 ->2 / 3) are set to Tc for the temperature threshold of ** (2/3 ->1/3), and Tb' and the temperature threshold of (2/3 ->3 / 3) are determined [ the temperature threshold of (0/3 ->1 / 3) of hard flow ] for Ta' and the temperature threshold of (1/3 ->2 / 3) as Tc' to this. At this time, it is [0033]. It considers as the relation of Ta>=Ta', Tb>=Tb', and Tc>=Tc' (however, the conditions which make all these three formulas an equal sign are removed).

[0034] Thus, a fluctuation frequency frequency can be moved in the low-pass direction by being easy to maintain the duration time of each energization pattern. Although this 2nd modification is employable independently of the 1st modification, it is also possible to use both modifications together. moreover, both modifications — both — again — ** — it is [ in / it is independent and / the gestalt of implementation of the above 2nd ] employable.

[0035] All were based on 3 half-wave length periods in the above example. Here, the advantage of applying wave number infanticide on the basis of 3 half-wave length periods is explained briefly. For example, since it will become the same dc component as a half-wave rectification wave if one period of an energization pattern is seen as the 2 half-wave lengths (one period of a sine wave form), and it will thin out by the 1 half-wave length from now on, the control top problem of a halogen heater is large. Moreover, infanticide with a period longer than 3 half-wave length periods becomes sensitive as CHIRATSUKI on the property of CHIRATSUKI, such as lighting, at the eyes of the infanticide actuation itself and a man. Therefore, it will be said that it is appropriate to think, the shortest periods, i.e., 3 half-wave length periods, other than 2 half-wave length periods. In fact, in infanticide of this 3 half-wave-length period, most of the place which connected lighting actually and observed CHIRATSUKI, and a feeling of CHIRATSUKI was not sensed.

[0036] However, it is also possible to make the half wave of the odd number of 5 and 7 grades into a criteria period. In such a case, if compared with 3 half-wave length periods, though effectiveness will fall in respect of CHIRATSUKI, in addition, the effectiveness of reduction of current variation is accepted. The number of the temperature threshold in the case of m half-wave length period (m is three or more odd number) turns into the same number m.

[0037] underline Drawing 7 is the circuit diagram of the control circuit for realizing

"wave number control" of the gestalt of this operation mentioned above.

[0038] TH in this drawing is a thermistor temperature sensor (5 in <u>drawing 1</u>) which detects the temperature of a heater roller (1 in <u>drawing 1</u>). This sensor TH is connected to resistance R1, and that partial pressure potential is inputted into analog input terminal A/D in a central processing unit CPU. Analog-to-digital conversion of the signal given to the A/D terminal is carried out, and it is processed within CPU. The zero cross pulse generated in the zero crossing point of supply voltage is inputted into the interruption input terminal INT of CPU. The generating circuit of this zero cross pulse is constituted by the photo coupler PC of the upper part of <u>drawing 7</u> and Comparator COM, resistance R5-R10, and Diode D.

[0039] According to falling of a zero cross pulse, the interruption routine inside CPU (after-mentioned) is started, and the signal OUT which makes Heater HT (4 in <u>drawing 1</u>) turn on or switch off immediately after this zero cross signal falling is outputted. For example, when an OUT output is H level, Transistor TR was set to OFF and the luminescence side of phot triac PT has gone out. Since the light-receiving side of phot triac PT is also OFF at this time, the gate current of Triac T does not flow. Therefore, Triac T will be in an OFF condition and a heater will be switched off. Reversely, when OUT is LOW level, reversely, actuation of above-mentioned reverse is carried out, TR turns on the light emitting diode of ON and PT, and a phot triac PT light-receiving side turns on. Since a phot triac PT light-receiving side flows through GETOHE of Triac T, the gate current the ** style was carried out [ gate current ] by resistance R2 or R3 is supplied. Therefore, Triac T is flowed through it and turns on a heater. It is a snubber circuit, and when R4 and C1 which were connected to juxtaposition at T have the abrupt change of supply voltage under the effect of an outpatient department noise etc., it is for preventing that Triac T turns on independently.

[0040] <u>Drawing 5</u> explains again the process of the heater control in the gestalt of this operation by the circuit of this <u>drawing 7</u>. Three thresholds which gave the relation of Ta>Tb>Tc for control temperature as illustrated first are set up. When the temperature detection signal inputted into the A/D terminal in <u>drawing 7</u> is below Tc, all energization patterns (3/3) are given to a heater and temperature becomes the range of Tb>=T>Tc, an energization pattern (2/3) is given to a heater. Furthermore, when temperature rises and it is set to the level of Ta>=T>Tb, heater energization power is reduced more and an energization pattern (1/3) is impressed. When temperature serves as T>=Ta, a non-energized pattern (0/3) is given. When temperature has fallen, the process of the aforementioned reverse is followed and it is made to increase the power of energization (1/3) -> energization (2/3) -> energization (3/3) and a heater with temperature (the process of (b) is shown in <u>drawing 5</u>.).

[0041] The actual temperature control (temperature control) condition under standby to <u>drawing 8</u> and print (copy) is shown. If the mean power under standby is 1/3 or less [ of all heater power ], temperature balances in the form which goes back and forth between energization (0/3) and energization (1/3). Moreover, if the mean power under print is between (2/3) with (one third) of all heater power, temperature will balance in the form where during energization (1/3) and energization (2/3) is gone back and forth. As illustrated, when the switch frequency of an energization condition is high, to a flicker value, it works disadvantageously. Therefore, as an example for which this frequency is reduced, when it rushes into a certain energization condition, as mentioned above, it is possible to define the minimum duration time which stops at that condition, and to reduce this frequency by things.

[0042] At the time of the first equipment power source ON included in a standby condition, it is energized (3/3) and the rush current may occur so that <u>drawing 8</u> may show. However, once temperature reaches the maximum threshold Ta, from energization (0/3), energization (3/3) is surely reached via energization (1/3) and (2/3). That is, it can be said that this invention is turned to the heater control at the time of temperature control other than the time of equipment power-source ON. In order to cope with the rush current at the time of the equipment power source ON, immediately after the equipment power source ON may adopt the above conventional technique.

[0043] The flow chart over <u>drawing 9</u> and <u>drawing 10</u> explains the software procedure for realizing said control. Here, let the case where the minimum duration time is set to a predetermined value on the basis of 3 half-wave length periods be an example.

[0044] since the zero cross pulse is given from said zero cross pulse generating circuit to the interruption input terminal INT to CPU ( <u>drawing 7</u> ) -- every [ of this pulse ] generating (pulse falling) -- the processing in CPU -- interrupting (INT) -- the flow procedure which starts and begins from <u>drawing 9</u> is performed.

[0045] First, the temperature sample flag (a flag is expressed with F in the following and <u>drawing 9</u> , and <u>drawing 10</u> ) which directs the timing which should carry out the sample of the heater roller temperature by the decision step S1 is investigated. Set of this flag and reset are performed at the step mentioned later. If this flag is set, Y side HEFURO of S1 will shift and the sample of the temperature T will be carried out (S19). Subsequently, the range where temperature T belongs by the decision steps S2 and S3 and S4 is judged, and it moves to a corresponding details flow.

[0046] If it is T>Ta at the decision step S2, it will shift to the Y side and, specifically, only the energization status flags 0/3F will be set among the energization status flag group 0 / 1 / 2 / 3 [ 3F and ]/3F. [ 3F and 1 ] [ 3F and 2 ] And it shifts to a juncture (d).

[0047] If it is Ta>=T>Tb at the decision step S3, it will shift to the Y side and it will be confirmed whether the energization status flags 1/3F are already set (S6). A continuation counter is started if not set (S23). This continuation counter is for measuring the minimum duration time mentioned above. Subsequently, the energization status flags 1/3F are set, and all other energization status flags (1/2 / 3 [ 3F and ]/3F) are reset (S24). [ 3F and 2 ] Also when the energization status flags 1/3F are already set at the decision step S6, this step S24 is performed for a sense.

[0048] If it is Tb>=T>Tc in decision step S4, it will shift to the Y side and it will be confirmed whether the energization status flags 2/3F are already set (S7). A continuation counter is started if not set (S25). Subsequently, the energization status flags 2/3F are set, and all other energization status flags (0/1 / 3 [ 3F and ]/3F) are reset (S26). [ 3F and 1 ] Also when the energization status flags 2/3F are already set at the decision step S7, this step S26 is performed for a sense.

[0049] If it is not Tb>=T>Tc in decision step S4 (i.e., if it is Tc>=T), it will shift to the Y side and it will be confirmed whether the energization status flags 3/3F are already set (S8). A continuation counter is started if not set (S27). Subsequently, the energization status flags 3/3F are set, and all other energization status flags (0/1 / 2 [ 3F and ]/3F) are reset (S28). [ 3F and 1 ] Also when the energization status flags 3/3F are already set at the decision step S8, this step S28 is performed for a sense.

[0050] Following said S22, S24, S26, and S28, when the temperature sample F is not set at the decision step S1 mentioned above, an infanticide counter is incremented (S20). The increment of the infanticide counter is carried out for every interruption, and if the value is set to 3, it will be reset by (S9) and 0 (S21). Therefore, the value of an infanticide counter is 0->1->2->0->... It goes round in a form. This infanticide counter is for managing wave number infanticide timing by supervising that value by consecutive processing. That is, it shifts to the decision steps S10, S11, S12, and S13 of drawing 10 , and the interruption corresponds to which half wave in 3 half waves, and it judges [ which turns on the half wave concerned according to the established state of each energization status flag at the event / or or ] whether OFF is carried out, and the output of a control signal is directed.

[0051] At the decision step S10, the existence of the set of the energization status flags 0/3F is seen, if it is Yes, it will thin out, and it is not concerned with the value of a counter, but an output signal OUT is turned on, and, specifically, a heater is switched off (S31).

[0052] At the decision step S11, the existence of the set of the energization status flags 1/3F is investigated, if it is Yes, it will thin out, only when a counter is 0, a heater is turned on (S33), and (S14, Yes) when other, it turns off (S32). only one half wave in 3 half waves is set to 4 with ON and 2

half-wave infanticide.

[0053] At the decision step S12, the existence of the set of the energization status flags 2/3F is investigated, if it is Yes, it will thin out, only when a counter is 2, a heater is turned off (S35), and (S15, Yes) when other, a heater is turned on (S34). That is, it will thin out 1 half wave of the three half waves (when an infanticide counter is 2).

[0054] At the decision step S13, the existence of the set of the energization status flags 3/3F is investigated, if it is Yes, it will not be concerned with the value of an infanticide counter, but a heater will be set to ON (S36). That is, a heater serves as all energization. If a decision result is No at the decision step S13, the temperature sample F will be set (S37) and this interruption processing will be ended (a return is carried out). Step S37 is for coping with it, when neither of the energization status flags is set by some reasons of an initial event etc.

[0055] At the decision step S16 following ON/OFF setting out of each heater of S31-S36, an infanticide counter value is investigated and that it is the break (the last half wave) of 3 half-wave length periods, i.e., an infanticide counter value, investigates whether it is 2. If it is not the location of such a break, the return of the temperature sample F will be reset and (S39) carried out.

[0056] It thins out at the decision step S16, and when a counter is 2 (i.e., when it comes to the break (the last half wave) of 3 half-wave length periods), a continuation counter investigates whether it is under [ count ] ****** at the following decision step S17. During a count of a continuation counter, what the continuation counter started by either of previous steps S23, S25, and S27 is meant. A continuation counter will be incremented if it is under count (S38). This continuation counter is set up in order to maintain an energization condition beyond fixed time amount (multiple of 3 half-wave length periods) compulsorily, as mentioned above. If this continuation counter has not reached a predetermined value (S18, No), it shifts to a juncture (g). Here, the temperature sample F is reset (S39). Therefore, in the following interruption cycle, a temperature sample is not made, but will be thinned out and the wave number infanticide energization based on a counter value will be maintained succeedingly. Thus, the minimum duration time of an energization condition is managed with the continuation counter.

[0057] A continuation counter is stopped when the continuation counter has reached the predetermined value in S18 (S40). Moreover, it directs to perform a temperature sample at the beginning of (S41) and the following interruption routine, and to switch an energization condition according to a temperature sample by setting the temperature sample F.

[0058] The sample of the temperature T will be carried out (S19), it will shift to the Y side at step S1 at the beginning of the following interruption routine

after the temperature sample F was set at step S41 ( drawing 9 ), and the temperature T will be investigated. For example, if temperature is in Ta>=T>Tb, it will flow to the Y side of the decision step S3, and will judge whether the energization status flag before set at step S6 is the same as the energization status flags 1/3F to be set from now on. not starting a continuation counter and having made it stop freely, when the same -- carrying out -- said -- only 1/3F are set (S24), and it is made to shift to the next juncture (d) Henceforth, since 2 half-wave infanticide was made between 3 half-wave-length periods and Y side) and a continuation counter have already stopped by the break of 3 half-wave length periods (S16, processing shift is carried out by S17 at the N side, and temperature Sun Bull F is set again (S41).

[0059] If it flowed to the Y side at the decision step S1 similarly at the time of the next interruption routine initiation, for example, temperature passed decision step S4 by Tb>=T>Tc, it considers that it has a switch of an energization condition at the decision step S7 since the last energization condition F was 1/3F, processing shift is carried out to the N side, and a continuation counter is started (S25), and 2/3F are set (S26). This 2/3 energization would be directed to the continuation counter at least, and will carry out time amount continuation.

[0060] In the decision step S2, the last flag is not investigated by the Y side, there are no start directions of a continuation counter, and the minimum duration time of the energization F (0/3F) set here is not specified. That is, with the gestalt of this operation, continuation exceeding 3 half-wave length periods is not intentionally directed to 0 / 3 energization condition. Since full putting out lights of a fixing heater of continuing from a viewpoint of fixable [ to a form ] is not desirable, compulsory continuity is made into the condition that there dares be nothing.

[0061] The following matters are mentioned as a merit of the gestalt of this operation of 3 half-wave length criteria expressed above.

[0062] (1) The energization which does not have infanticide of a half wave by making into a period a part for the 3 half-wave lengths which supply voltage follows (3/3), Four steps of energization patterns [ having the energization which thins out one half wave by making the 3 half-wave lengths into a period (2/3), the energization which thins out two half waves (1/3), and no energization (0/3) ] by 4 value control matched with the quadrisection range of the temperature for heating of a heater, respectively Compared with the conventional binary control, the temperature control of finer high degree of accuracy can be attained.

[0063] Simultaneously, in a continuous temperature control, since change (difference) of an energization condition is always a part for a half wave per 1/3 (refer to drawing 8 ), 1 [ i.e., ], period, a rapid current change of heater energization can be reduced effectively.

[0064] (2) Moreover, control hardware is comparatively simple. For example, in the case of a phase control method which was mentioned above, it is necessary to generate the pulse which specifies the phase angle which should set up a timer from the zero crossing point of supply voltage, and should turn on a heater. These must prepare hardware, such as the complexity of the control [ itself ], and a timer style. On the other hand, if it is "wave number control", since it is only turning on a heater on a zero cross origin, the timer which determines a phase becomes unnecessary. Moreover, the complexity on control, such as those setting out and starting, decreases that much.

[0065] (3) Further, since the heater current in "wave number control" is impressed from a zero cross origin, it does not almost have a high order frequency current change of the power line period on a power-source line, and generating of the so-called power-source higher harmonic. Usually, such a problem is solved by the gestalt of this operation, although the mass inductance (choke coil) was inserted in the heater and the serial and it had become a failure over miniaturization of the machine by reservation of cost lifting by addition of an excessive electrical part, and its installation, in order to suppress generating of such a power-source higher harmonic wave.

[0066] As mentioned above, although the gestalt of suitable operation of this invention was explained, various deformation and modification are possible.

[Translation done.]

* NOTICES *

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the schematic diagram of the fixing roller as a target example with which this invention is applied.
[Drawing 2] It is drawing showing the heater energization current wave form at the time of the conventional ON/OFF temperature control for the temperature control of the heater roller of drawing 1 .
[Drawing 3] It is the explanatory view of energization of HITAHE by the conventional phase control (conduction angle control).
[Drawing 4] It is the explanatory view of generating of fluctuation of the supply voltage resulting from device current variation.
[Drawing 5] the wave of the energization condition (b) of the different number of infanticide from four temperature requirements (a) in the gestalt of operation of this invention, and a different energization condition -- it is drawing showing (c).
[Drawing 6] It is the explanatory view of the energization pattern which made 3 half-wave length periods the set by two periods, and made six half waves one new period in the gestalt of other operations of this invention.
[Drawing 7] It is the circuit diagram of the control circuit for realizing wave number control of the gestalt of operation of this invention.
[Drawing 8] It is the wave form chart showing an example of the actual temperature control (temperature control) condition under standby with the gestalt of operation of this invention, and print (copy).
[Drawing 9] It is the flow chart which shows the software procedure for realizing wave number control in the gestalt of operation of this invention.
[Drawing 10] It is a flow chart following drawing 9 .
[Description of Notations]
1 Heater Roller
2 Application-of-Pressure Roller
3 Form
4 Heater
5 Thermistor Temperature Sensor

[Translation done.]